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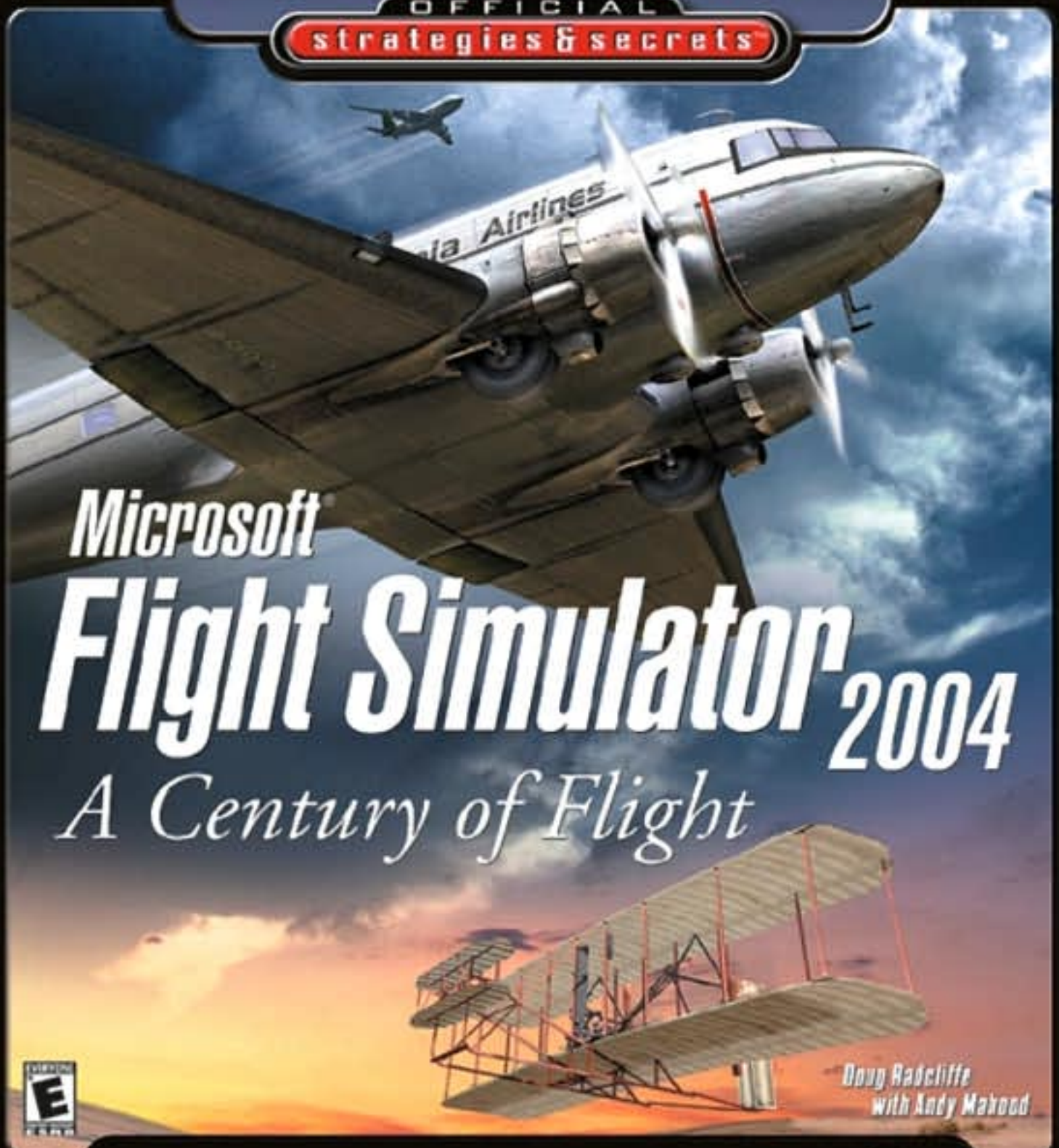

Microsoft Flight Simulator 2004

A Century of Flight

Doug Radcliffe
with Andy Mahood

The Only Official Guide from Microsoft game studios and SYBEX

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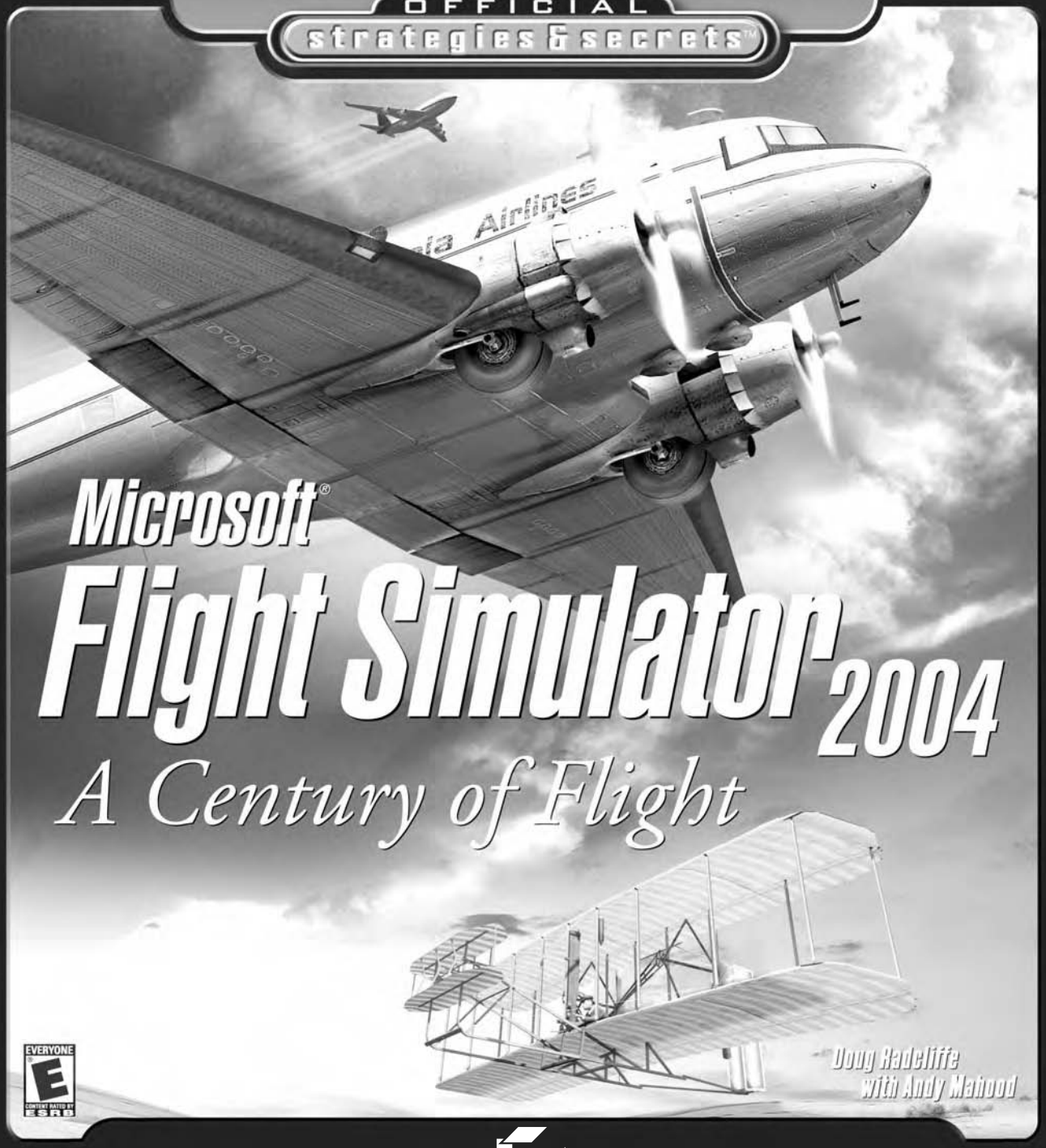

Microsoft® Flight Simulator 2004

A Century of Flight

EVERYONE E CONTENT RATED BY ESRB

Doug Radcliffe
with Andy Mahood

SYBEX®
San Francisco • London

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To faith.

Acknowledgments

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Thanks as always to the awesome team at Sybex for another job well done. To Willem Knibbe, who never sounds annoyed to hear my voice even when it's the tenth time I've called him in under an hour. Thanks to Patrick Cunningham for his scheduling expertise and Michael Johnson for his copy editing mojo. And a gigantic thanks to Andy Mahood for his invaluable contribution to this guide, the expertly written Chapters 6 and 7. You're a true professional.

Contents

How to Use This Book

This official strategy guide to *Flight Simulator 2004: A Century of Flight* was written with the full support of the Microsoft Games Studios design team.

Chapter 1: Systems Checklist offers guidance on optimizing your computer and operating system for *A Century of Flight*. You'll find complete coverage of detail, aircraft, weather, and hardware settings to achieve the best performance without sacrificing visual quality. This chapter also includes a section on troubleshooting *Flight Simulator* controllers written by Dean Bielanowski from Computer Pilot magazine (http://www.computerpilot.com).

Chapter 2: Modern Aircraft Reference is an invaluable reference tool for all of the modern aircraft featured in *A Century of Flight*. The section on each aircraft includes specifications, target and critical airspeeds, and flying tips, and serves as a vital quick reference for simulator users. Related Web links are provided for readers seeking more information about particular aircraft.

Chapter 3: Historical Aircraft Reference is a compilation of specifications, reference airspeeds, and flying tips for all the historical aircraft offered in *A Century of Flight*. From the Wright Flyer and Curtiss "Jenny" to the Douglas DC-3 and the *Spirit of St. Louis*, the facts are included in this quick reference guide for new and experienced pilots alike. Informative Web links point the way to places where readers can search for restoration projects, stories, and more data on favorite historical aircraft.

Chapter 4: The Learning Center provides an overview of *FS 2004's* invaluable Learning Center, where pilots at all skill levels will find answers on crucial topics. Also included is coverage of new features in this version of *Flight Simulator*. Novices should start here and follow the Student Pilot tutorial guide. We'll walk you through your first solo flight.

Chapter 5: From Taxi to Takeoff covers all the essential things you have to do in order to leave the ground. You'll get some preflight planning tips, and learn to use the Flight Planner. Look here for tips on taxiing each type of aircraft, including *taildraggers* and *heavies*. We have compiled runway and takeoff speed information in an informative table format covering all modern and historical aircraft. We also give you short-field and crosswind takeoff procedures, along with a takeoff challenge to put your skills to the test.

Chapter 6: In-Flight Navigation, written by Andy Mahood, provides detailed tips on the real-world navigation techniques used in *Flight Simulator*—from visual pilotage and dead-reckoning navigation to modern GPS instrumentation. You'll find tips on visual navigation in the historical planes, and on VOR, NDB-and-ADF, and GPS navigation in the more modern craft. Included with each are invaluable flight challenges designed to make you apply each concept you learn to an actual flight in *Flight Simulator*. We'll clearly outline the tasks and

setups for each challenge, and we'll provide tips for users who wish to attempt the challenge without extensive help. A step-by-step solution reveals the complete explanation for the moves involved in conquering the navigation challenge. This extensive chapter also covers using and troubleshooting the autopilot, communicating with Air Traffic Control (ATC), emergency procedures, and airspace definitions.

Chapter 7: Approaches and Landings gives you plenty of approach and landing tips covering a variety of navigational techniques. You'll find detailed instructions for completing a visual approach and landing and instrument approaches and landings, with a non-precision GPS approach and an ILS approach—and we'll challenge you on each method. Other topics include Air Traffic Control contact during approaches and landings, short-field and crosswind *landings,* and helpful tables compiling runway and landing speed information for all modern and historical aircraft. This chapter was written by Andy Mahood.

Chapter 8: So You Want To Be A… offers *Flight Simulator* users the chance to take part in three very different types of flying. In this chapter, you'll assume the role of a bush pilot, an airline pilot, and an aerobatic pilot. You'll find tips on setting up each of these flights, as well as useful Web links where you can learn more about *Flight Simulator* groups geared toward each particular type of flying. Of course, we've come up with unique challenges to test you on each type of flying.

Chapter 9: The Multiplayer Skies tells you how to optimize your connection for, and how to set up, a *Flight Sim* multiplayer session. This chapter also provides a bridge into the Flight Simulator Internet community, and we talk about add-ons that will enhance your multiplayer experience. You'll also find a challenge: You can set up your own multiplayer session, an air race through Nevada.

Chapter 10: *Flight Simulator* Community is a primer on the enormous Internet community of *Flight Simulator* aficionados. Important *Flight Simulator* resource sites are highlighted, including Microsoft's own *Flight Simulator Insider* Web site. Learn more about the endless number of add-on aircraft, scenery, and utilities programs, and discover an exclusive Web-links table filled with valuable Web sites.

Appendix A: Common Problems for New Users provides a "frequently asked questions" table covering problems common to users new to *Flight Simulator*.

Appendix B: Checklists is a compilation of full checklists for all modern and historical aircraft included in *FS 2004*.

Appendix C: Keyboard Reference Chart is the complete map of *Flight Simulator* keyboard commands for flight functions.

CHAPTER 1
Systems Checklist

Before taking off, a pilot runs through a checklist, making sure each system and control on his or her aircraft is ready for flight. Before you take the controls of* Flight Simulator 2004: A Century of Flight*, use this chapter as your checklist, adjusting settings both on the simulation and on your PC. This is important if you want the best possible flight-simulator experience.

In this introductory chapter we give you tips on optimizing your system for flight simulation, on tweaking* Flight Simulator*'s display and sound settings to improve performance and enjoyment, and on adjusting the simulation's level of realism to suit your level of expertise. This chapter also covers flight-simulator controllers—joysticks, yokes, even pedals—that are more sophisticated than your mouse, and offers tips on troubleshooting controller problems.

Configuring Your Flight Simulator

Microsoft's *Flight Simulator 2004: A Century of Flight* can push high-end personal computers to their limits, but also can be enjoyed on computers that just meet the minimum system requirements. *Flight Simulator* is highly configurable. You can adjust many display and graphics hardware settings to increase performance.

High performance, however, usually comes at the expense of some visual and aural clarity. The goal is to strike an agreeable balance between impressive graphic effects (detail and clarity) and simulator performance, which typically is measured by frames per second, or *frame rate*, on your monitor display.

Tip *Press the keyboard shortcut Shift+Z twice to display your current frame rate during a flight. You can then adjust display and hardware options to gauge which options increase and decrease your frame rate. Use this to achieve a balance between clarity and smoothness.*

The higher your frame rate, the smoother the simulator's animation. At lower frame rates, your aircraft in *FS 2004* will appear to stutter, instead of gliding smoothly. Low frame rates also can cause control problems. The stuttering effect creates an unreliable controller response, in which the simulation does not immediately respond to your commands. This latency might make you inadvertently overcompensate, making things still worse. To improve performance, you should make sure your PC systems are optimized, and make adjustments to the simulation's display settings.

On the other hand, as I said, the goal isn't necessarily to achieve the highest possible frame rate. It's more important to locate the pleasant balance between visuals and smoothness. Many *Flight Simulator* pilots strive for a frame rate of 20 to 30 frames a second.

The next section offers guidance on optimizing your system to improve flight simulator performance, and explains *Display, Sound,* and *Realism* settings.

System Optimization

Whether you're using a top-of-the-line gaming PC or an older personal computer that just meets the minimum system requirements for *Flight Simulator 2004,* there are many things you can do to help increase the simulation's performance (see Figure 1.1).

Note *You should also consult the Learning Center (discussed in Chapter 4) and its section on "Optimizing Visuals and Performance" for additional advice on optimizing your system for* Flight Simulator 2004.

Figure 1.1: *Every player wants a smooth* Flight Simulator *experience. This chapter provides a "checklist" for optimizing your system.*

Before even beginning to discuss tweaking and adjusting, there are some hardware and software issues that cannot be entirely ignored.

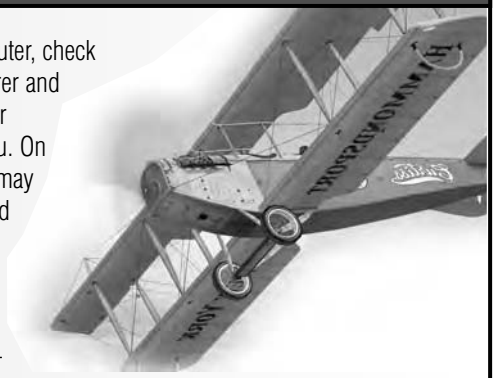
- **Minimum Requirements:** *FS 2004* has minimum system requirements of 64MB of system RAM for Windows 98 or Windows ME machines, and 128 MB of system RAM for Windows 2000 or Windows XP machines. *FS 2004* also requires at least a 450 MHz processor.
- **Time to upgrade?:** The two items of hardware in your own system to which upgrades will dramatically improve *FS 2004* performance are your 3-D graphics accelerator card and your system RAM. (Increasing the speed of your computer's processor also has a significant effect on the simulation.) A 3-D card with high video RAM (64 megabytes or more) can lower the time required to shift textures to the graphics card. And increasing system RAM allows more information to be placed in memory, which is accessed faster than the computer's hard drive.

Even if you are running the bare minimums in megahertz and memory, however, the following general suggestions will improve your system operation, which in turn will increase *Flight Simulator's* performance.

- **Latest 3-D video card drivers:** To meet the minimum graphical requirements of *Flight Simulator 2004: A Century of Flight*, you must have a 3-D graphics accelerator card with at least 8MB of video RAM (VRAM), and we recommend at least 32MB, which strikes a balance between speed and affordability. The more VRAM you have, the better your frame rate. Whether you're using an older video card or the latest and greatest, it's important to install an updated *driver* for your video card. The driver is software that

allows your video card to communicate efficiently with the rest of your PC. Typically, newer drivers show performance increases over older versions. Newer drivers also are typically more stable and more compatible with the latest games and software. Consult your computer's or video card's manual or Web site for information on obtaining and installing your video card's latest driver (and see the accompanying sidebar).

Updating Your 3-D Video Card Drivers



If you aren't sure about what video card you have inside your computer, check your computer's display properties, which often tells the manufacturer and type of card in your machine. In Windows 95/98/XP, right-click your mouse on the desktop, then select *Properties* from the pop-up menu. On the display properties menu, select the *Settings* tab at the top (you may also need to press the *Advanced* button on the *Settings* menu to find evidence of your card type).

You can also check in your device manager. On Windows 95/98, right-click on the *My Computer* icon and select *Properties* from the pop-up menu. Select the *Device Manager* tab at the top. Press the + symbol next to *Display Adapters* to see which card you have. On Windows XP, launch the control panel and select *System*. Use the *Hardware* tab and go into the *Device Manager*.

The links shown here will take you to current pages for popular video card drivers. These links, which were accurate and active when this was written, are for video card manufacturers including NVIDIA, creators of the GeForce chipset, and ATi, creators of the Radeon chipset. Both the GeForce and Radeon chipsets are featured in most new computers. The third link is for 3-Dfx, creators of the popular Voodoo chipset used in many older cards. If you are unsure of your 3-D video card manufacturer, consult your computer manual or call your computer dealer. If your card isn't manufactured by one of the three companies mentioned, search for your manufacturer at a hardware-focused Web site, such as The Guru of 3-D at http://www.guru3-D.net, which houses many video drivers and has discussion forums that could provide the assistance you need.

For NVIDIA cards, use the link http://www.nvidia.com/content/drivers/drivers.asp. Choose *Graphics Driver* in step 1; choose your card type in step 2; and choose your operating system in step 3. Press the *Go!* button when finished to search for the appropriate drivers. Follow the installation instructions to install the latest NVIDIA 3-D video drivers.

For ATi cards, follow the link http://mirror.ati.com/support/driver.html. Choose your operating system in step 1; select your product name in step 2; and read and agree to the license agreement in step 3. Press the *Next* button when finished. Read the installation tips before downloading the appropriate drivers, and follow all the installation instructions.

For 3-Dfx cards, use the link http://www.voodoofiles.com/type.asp?cat_id=0. Consult the file descriptions to find the appropriate driver for your video card.

- **Other updated drivers:** Outdated video card drivers will be the biggest drag on your simulation, but it's also important to update the drivers for your motherboard and sound card. Consult your computer's manual or Web site for information. Updating these drivers might not cause a dramatic increase in *FS 2004's* frame rate or performance, but it can help improve overall system performance and stability.
- **Latest Windows updates:** Check Microsoft's Web site for updates to your Windows operating system. Regardless of which supported version of Windows you use, proceed to the Windows Update Web site at http://v4.windowsupdate.microsoft.com/en/default.asp. You also should obtain the latest *Service Packs* for your version of Windows, which can be found at the same site.

WARNING

These system-optimization tips have proved successful in increasing performance on our test machines. However, if you aren't comfortable performing these optimizations, don't try them without further technical assistance. We can't provide technical support or accept liability for changes to your computer or system.

- **Defrag hard drive:** Defragging your hard drive regularly can increase the performance of all your applications. On Windows 95/98/XP, select *Disk Defragmenter* under the *System Tools* section of your programs and accessories. The amount of time you'll need for the defragging process depends on the size of your hard drive (which, on the newest computers at the time of this writing, can be greater than 100 gigabytes!). Defrag your hard drive when you're not using your computer, and let the process complete in full.

After performing the system checklist outlined above, implement the following tips just before launching *FS 2004*. They will specifically increase the simulation's performance.

- **Close background programs:** You should shut down any unnecessary programs before launching the simulation. These programs consume your system resources, and *Flight Simulator 2004* wants all the resources it can get. Press Ctrl + Alt + Delete to see which background programs are running, and shut down any that are not currently necessary. The only caveat: Don't shut down the programs *Explorer* or *Systray,* which are required by Windows.
- **Disable anti-virus scanning software:** Because anti-virus scanning software can check your system's files periodically, it can cause stutters and decreased frame rates in some games. Disable or shut down your anti-virus software before launching *FS 2004*. Upon completing a session of *FS 2004*, however, be sure to activate or reload your anti-virus scanning software to resume virus protection.
- **A fresh reboot:** If you haven't restarted your computer in a long time, consider shutting your system down and rebooting. Afterward, shut down any unnecessary startup programs that might have been launched, as indicated in the first bullet point in this section, then start *FS 2004*.

➢ **Adjust your *Flight Simulator's* settings:** Now you can make adjustments to the *FS 2004* display and hardware settings, balancing increased performance with visual clarity. For more on adjusting *Flight Simulator's* display and hardware settings, see the section immediately below.

Display Settings

Like previous versions of *Flight Simulator*, *FS 2004* offers highly customizable display settings. This allows the user to adjust many of the visual aspects of the simulation to attain a satisfactory balance between graphical clarity and smooth performance (see Figure 1.2).

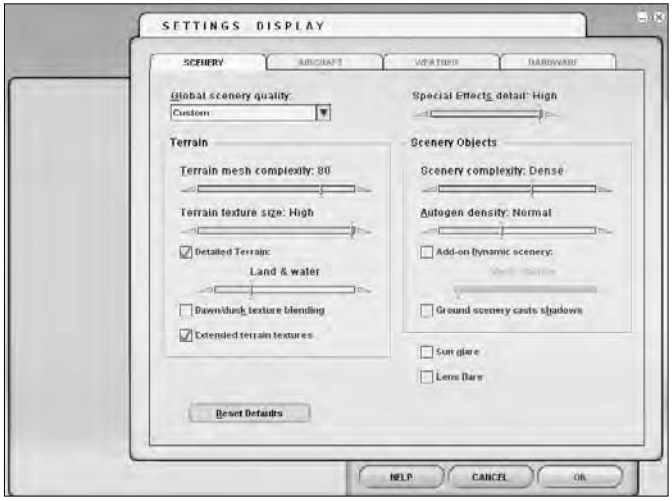


Figure 1.2: *The simulator's versatile display system is your most important tool for improving frame rate.*

Click on the *Settings* option in the *FS 2004* Main Menu. A screen reveals the numerous configurable settings available in the simulator. Click on the *Displays* button to activate the display settings screen. There are four sub-menus under Displays: *Scenery, Aircraft, Weather,* and *Hardware. Scenery* is the default sub-menu; change to the other menus by clicking the tabs at the top of the screen.

The following section covers everything under the three tabs—*Scenery, Aircraft, and Hardware*—and provides explanations and instruction for each specific setting.

Scenery

The *Scenery* tab controls specific items of scenery, including the appearance of water, the number and detail of objects in the terrain, and your range of visibility. The *Scenery* tab has a great impact on *Flight Simulator's* performance. If you're looking to increase your frame rate slightly, read the descriptions below and adjust specific settings to improve the simulator's frames per second.

➢ **Terrain Mesh Complexity:** This setting controls the complexity of *outlines* of scenery shapes. For example, a mountain would appear to have fewer points—be smoother—if you increase complexity. This setting has the greatest effect on hilly or mountainous terrain and can cause a significant hit to frame rate if set to *Maximum* on a lower-end machine. Some *FS* users keep this setting at *zero,* with the drawback being the lack of mountains and hills on the horizon, and the benefit being a sizable increase in performance.

- **Terrain Texture Size:** The larger the terrain texture size, the greater the terrain detail at longer ranges. If you adjust this setting to *Low,* the terrain will retain high detail only when you fly low. Adjusting this setting higher means the terrain retains detail at increased heights.
- **Detailed Terrain**: Toggle this setting on or off to add detailed terrain textures to a variety of in-game objects. A slider governs the level of detail for four different settings: It can be set to *Land Only, Land & Water, Land Detail & Water Reflection, Land & Water Detail + Reflection,* and *Land & Water Detail + Depth.* Turning *Detailed Terrain* on will substantially tax your performance, but it will improve the graphics dramatically. As for the slider, the leftmost *Land Only* setting gives you the least graphical improvement and the best performance, while the right side, *Land & Water Detail + Depth,* offers top-notch graphics but the most significant slowdown in performance. We recommend adjusting the slider beyond *Land Only* only if you have a high-performance computer system. Detailed and reflective water will slow your performance, even if the only water on screen is a small lake or narrow river. Keep water effect detail at *None* if you're looking to keep your frame rate high.

Developer Tip *If performance tuning is key, one thing to consider for less-than-top-of-the-line machines is to fix the frame rate at a set amount. Use a value of 24 frames per second, as this number is a good value that reflects how the human eye interprets frame rates on screen. The act of fixing your frame rate at a set amount in line with your machine's capabilities is that it frees up system processing to address other important needs.*

- **Autogen Density:** This setting governs the number of "auto-generated" objects, such as generic trees and buildings. You can set the density from *None* to *Extremely Dense.* This setting is naturally more important for visual flying. Though the setting adds realism to the terrain, it's also a huge performance hit. Consider setting this to *Sparse* or *Normal* to increase your frame rate. If you want high terrain detail, but don't mind fewer trees and buildings, lower this setting while keeping *Texture Quality* high.
- **Scenery Complexity:** This sets the density of *custom* buildings and scenery objects. This setting is more important when you're "visual flying," or looking for landmarks. Adjust the setting from *Very Sparse* to *Extremely Dense.* The denser your setting, the bigger the hit to your frame rate. Visual flyers shouldn't set this below *Normal*. Sightseers should set it as high as possible, while maintaining a respectable frame rate.

Tip *Overall performance isn't solely dependent on graphics and detail settings. For example, dropping the number of computer-controlled aircraft in the simulation can increase performance. While the experience won't be as realistic without the additional air traffic, your overall performance will improve. Select the* Traffic *option in the* Settings *menu. Use the* Air Traffic Density *slider to adjust the aircraft traffic volume on the ground and in the air.*

- **Add-on Dynamic Scenery:** This can be toggled on to display third-party dynamic—or moving—scenery. You can adjust it from *Very Sparse* to *Extremely Dense*. Selecting *Sparse* means you are willing to forgo graphical realism for the sake of performance; choosing *Extremely Dense* decreases performance but offers a greater level of realism.
- **Special Effects Detail:** This control affects the detail of certain special effects, such as smoke, dust, and waves. If you've also ramped up the *Detailed Terrain* slider dramatically (see earlier in this section), this can be a large performance hit when flying over bodies of water.
- **Ground Scenery Casts Shadows:** Toggle shadows of ground scenery, such as buildings and landmarks, on or off. Turning shadows off will increase performance at the cost of realism.
- **Dawn/Dusk Texture Blending:** This control toggles realistic transitions between night and day (those magnificent sunrises and sunsets). This will have no effect unless you're flying at dawn or dusk.
- **Extended Terrain Textures:** You can use this to see increased detail on scenery at a distance. Use this on cutting-edge gaming machines and combine it with a high *Maximum Visibility* setting.
- **Terrain Detail Textures:** Toggle this on (at a possible cost in performance) to see subtle enhancements to textures when viewed up close. This must be selected to see *Water Effects*.

Tip *When adjusting display settings, consider what graphical features you consider most important for realism. If water effects aren't that important to you, adjust* Water Effects *to its lowest option. Or if beautiful clouds are important, consider giving* Cloud Density *priority over other settings. As you attempt to balance graphics and performance, reduce the settings for the features you care about least.*

Instead of tinkering with each individual setting, it's possible to adjust a single global setting, which automatically sets each individual setting to its appropriate level. For example, adjusting the global *Scenery* setting to *Low* sets each individual scenery setting to *Low*. The following table reveals all of the preset global *Scenery* settings.

Table 1.1: Preset Global *Scenery* Settings

SETTING	MINIMAL	VERY LOW	LOW	MEDIUM LOW	MEDIUM HIGH	HIGH	ULTRA HIGH
Terrain Mesh Complexity	50	50	50	50	70	75	80
Terrain Texture Size	Low	Medium	Medium	High	High	High	High
Detailed Terrain	Off	Off	On	On	On	On	On
Detailed Terrain Slider	Off	Off	Land Only	Land Only	Land Only	Land Only	Land & Water
Autogen Density	None	None	Sparse	Sparse	Normal	Normal	Normal
Scenery Complexity	Sparse	Sparse	Sparse	Normal	Normal	Normal	Dense

(continued on next page)

Table 1.1: Preset Global *Scenery* Settings *(continuted from previous page)*

SETTING	MINIMAL	VERY LOW	LOW	MEDIUM LOW	MEDIUM HIGH	HIGH	ULTRA HIGH
Dynamic Scenery	Off	Off	Off	Off	Off	Off	Off
Effects Detail	Low	Low	Low	Low	Medium	High	High
Ground Scenery Casts Shadows	Off	Off	Off	Off	Off	Off	Off
Dawn/Dusk Texture Blending	Off	Off	Off	Off	Off	Off	Off
Extended Terrain Textures	Off	Off	Off	Off	Off	Off	On

Aircraft

The *Aircraft* tab under *Displays* controls details and special effects directly associated with the aircraft. Certain settings, such as *Reflections* and *Shadows,* can greatly enhance graphical realism. As usual, however, it's at the expense of performance. Read the descriptions of each setting below and adjust each as necessary to balance visual splendor with your desired frame rate.

- **Virtual Cockpit Gauge Quality:** This determines the clarity of your gauges in the Virtual Cockpit mode. The higher the setting, the greater the detail—and the greater hit to performance.
- **Reflections:** Toggle *Reflections* on to see sunlight and ground features reflected in aircraft surfaces. Toggle this off for increased performance.
- **Aircraft Cast Shadows:** Toggle this on to see your aircraft's shadow on the ground. It will slightly decrease performance.
- **Landing Lights:** Toggle this on if you want your aircraft's landing lights to illuminate ground objects. This can (of course) decrease performance.
- **Resize Panel with Main Window:** If you're not using the full screen, you can toggle this option on to automatically resize the cockpit panel when you resize the *FS 2004* window.

Instead of adjusting each individual setting, you can just switch the global *Aircraft Quality* setting, which automatically sets each individual setting to its appropriate level. The following table shows the preset global aircraft settings.

Table 1.2: Preset Global Aircraft Quality Settings

SETTING	MINIMAL	VERY LOW	LOW	MEDIUM LOW	MEDIUM HIGH	HIGH	ULTRA HIGH
Virtual Cockpit Gauge Quality	Low	Low	High	High	High	High	High
Reflections	Off	Off	Off	Off	Off	On	On

SETTING	MINIMAL	VERY LOW	LOW	MEDIUM LOW	MEDIUM HIGH	HIGH	ULTRA HIGH
Aircraft Cast Shadows	Off	Off	Off	On	On	On	On
Landing Lights	On	On	On	On	On	On	On
Resize Panel with Main Window	On	On	On	On	On	On	On

Weather

The *Weather* tab under *Displays* controls graphical quality associated with environmental conditions, particularly cloud cover and the details thereof. These settings can dramatically improve graphics but are some of the most taxing on your computer. Adjust these settings carefully.

- **Sight Distance:** You can adjust the distance (from 60 to 150 miles) at which objects become visible, with a significant impact on your frame rate. The higher the visibility, the more work it is for your computer and video card to render all of the added terrain and objects. If you are suffering from a bad frame rate, this is a *great* place to start tweaking. Lower your *Sight Distance* setting and observe the effects before adjusting other details.
- **Cloud Draw Distance:** As with *Sight Distance,* this slider governs the distance at which clouds will be "drawn" by the simulator. You can adjust the slider between 30 and 80 miles. The greater the *Draw Distance,* the more impact on the frame rate. If clouds aren't too important to you, set this at 30 miles and use simple *Cloud Detail* as described later in this section.
- **3-D Cloud Percentage:** This slider adjusts the percentage of 3-D clouds displayed. You must set the *Cloud Detail* toggle to *Detailed Clouds* to use 3-D clouds. *FS 2004*'s clouds are a beautiful sight, but heavy cloud cover, particularly with 3-D clouds, requires a lot of processing power. Prepare to adjust these cloud settings to improve performance if necessary.
- **Cloud Coverage Density:** This adjusts the density of clouds from *Low* to *Maximum*. If you prefer complex clouds, this is the setting to adjust, but the denser the cloud, the larger the effect on your aircraft's performance (see Figure 1.3). If your performance suffers but you must have clouds, you can adjust other settings to offset the increased cloud density. *Cloud Detail* must be set at *Detailed Clouds,* which are 3-D clouds, to use this setting. Otherwise, you'll use the *Simple Clouds* setting, which shows 2-D clouds only.

Figure 1.3: *Clouds in* FS 2004 *are magnificent, truly a sight to behold. But their complexity can tax your system. Consider lowering* Cloud Density *to improve frame rate.*

Instead of adjusting each individual setting, you can just switch the global *Weather Quality* setting, which automatically sets each individual setting to its appropriate level. The following table shows the preset global weather settings.

Table 1.3: Preset Global *Weather Quality* Settings

SETTING	MINIMAL	VERY LOW	LOW	MEDIUM LOW	MEDIUM HIGH	HIGH	ULTRA HIGH
Sight Distance	60 mi	60 mi	60 mi	60 mi	60 mi	60 mi	80 mi
Cloud Draw Distance	30 mi	30 mi	40 mi	40 mi	40 mi	50 mi	50 mi
3-D Cloud Percentage	20%	20%	20%	20%	30%	30%	40%
Cloud Detail	Simple	Detailed	Detailed	Detailed	Detailed	Detailed	Detailed
Cloud Coverage Density	Off	Low	Low	Medium	High	Maximum	Maximum

Hardware

Switch to the *Hardware* tab under *Displays* and select your display device (the fastest graphics card available in your system—a 3-D graphics card if you have it). Under this tab you'll find ways to adjust and toggle specific hardware options that affect graphical detail and clarity (see Figure 1.4). You'll also use the *Hardware* tab to switch between available display resolution and color depth. Generally, the higher the display resolution and the greater the color depth, the bigger the price in terms of your simulator's performance.

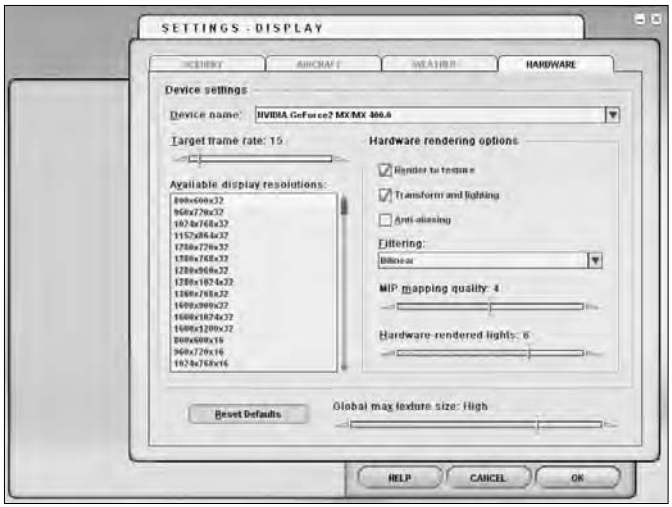


Figure 1.4: *Your* Hardware *options allow you to change resolution, color depth, and several specific 3-D card settings, such as multitexturing and filtering.*

- **Target Frame Rate:** Use this handy slider to set a frame-rate goal for your simulation. For example, if you set the slider to 25, the simulation will attempt to maintain approximately 25 frames per second. You may notice graphical clarity fluctuating to maintain the 25-frame speed. Unless you have a cutting-edge PC, consider a *Target Frame Rate* between 15 and 25 frames per second.
- **Render to texture:** This improves special effects by using multitexturing. Toggling it on may decrease performance.
- **Transform and Lighting:** This improves lighting effects.
- **Filtering:** This can make textures look more or less blocky in order to strike an optimum balance between performance and graphical clarity. You can set it to *None, Bilinear,* or *Trilinear.* These run in progression from *best performance, least quality* to *least performance, best quality.*
- **Anti-aliasing:** You can smooth out the jagged edges on objects by toggling this setting on. Anti-aliasing significantly improves graphical clarity, but effects a large performance hit.
- **MIP Mapping Quality:** Create greater or lesser illusion of depth by setting this between *None* and *10* in single-step increments.
- **Hardware-Rendered Lights:** You can adjust the number of "lights" used to light a particular object. The more lights used, the sharper the object looks. Set this between *1* and *8* in single-step increments.
- **Global Max Texture Size**: Governs the size of textures used for terrain, buildings, aircraft, and other objects. The larger the texture, the more detailed the texture. You can adjust this slider from *Very Small* to *Massive* and, as it sounds, setting it to *Massive* can be a huge performance hit. Set it to *Medium* and adjust downward, if you need to increase frame rate, or upward if you wish to improve graphical quality at the cost of some frames per second.

Tip *Head over to Chapter 10, "Flight Simulator Community," for a compilation of important, useful, and entertaining flight simulator resources on the Internet. Many of these Web sites offer forums where you can query other flight simulator players about specific technical or graphical issues.*

Sound Settings

From *Displays,* go back to the *Settings* option in the *FS 2004* Main Menu. A screen reveals the numerous configurable settings available in the simulator. Click on the *Sound* button to activate the sound settings screen (see Figure 1.5). Here you can adjust the quality of sound effects and the volume levels of six specific sound fields. *Sound Quality* will have a slight effect on performance, but the various volume levels are more a matter of personal taste, with no dues to pay in terms of system performance.

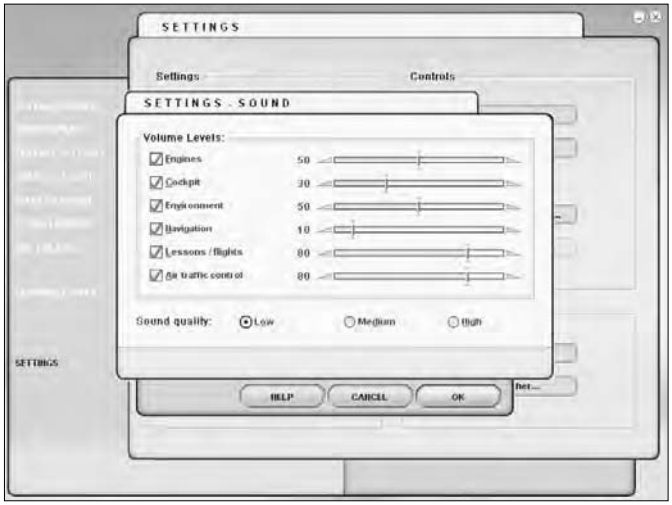


Figure 1.5: *Use the* Sound *settings screen to adjust volume levels of the plane's engines, cockpit sounds, or navigation beacons.*

- **Sound Quality:** This adjusts the quality of all your sound effects. Lowering it can slightly improve your performance.
- **Engines:** Here you can adjust the sound level of the plane's engines. Beware: Turning it too loud could drown out more important sounds, such as an instructor's voice or Air Traffic Control (ATC). And adjusting it to an inaudible level means you won't be able to detect stalls or engine failures as easily.
- **Cockpit:** This adjusts the sound level of interior cockpit sounds, such as gear and flap operations, speed-warning horns, and various other warning indicators.
- **Environment:** You also can set the volume level for other aircraft, wind, and crash noises, among other environmental sounds. This one can be set at a low level to leave more important fields more audible, unless you're flying a plane with no airspeed indicator (such as the Curtiss "Jenny"), or you really enjoy listening to yourself crash.
- **Navigation:** This one is important. It adjusts the sound level of important navigation tools, such as radio station identification codes and Instrument Landing System (ILS) marker beacons. Since these sounds aren't constant, leave the *Navigation* slider high so they'll be clear and audible.
- **Lessons/Flights:** Make sure, when you're flying *lessons* or *adventures,* to adjust this slider to an audible level or you won't be able to hear Rod Machado instruct you…or deliver his witty jokes!

- **Air Traffic Control:** You can adjust the sound level of Air Traffic Control voices. Set the slider higher than that of your *Engines* sound field, so you can clearly hear the instructions and information.

Realism Settings

Go back to the *Settings* option in the Main Menu. Click *Realism* to activate the realism settings screen. These settings won't directly influence performance or frame rate, because in *FS 2004,* the level of *Realism* refers to your level of challenge as a pilot (see Figure 1.6), not to the graphics.

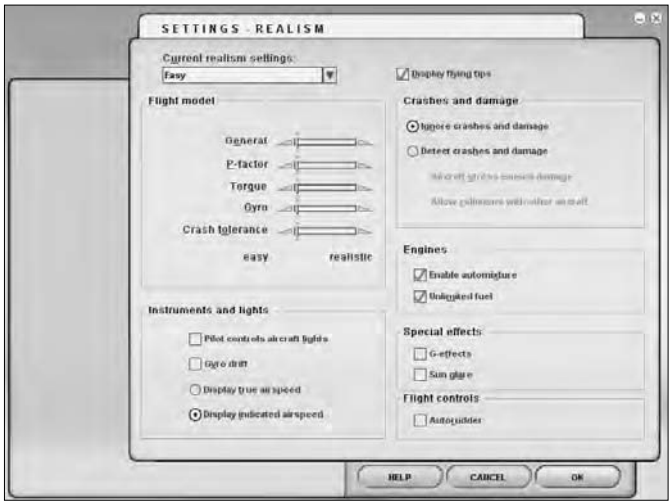


Figure 1.6: Realism *settings don't affect simulator performance but can make your flight experience easier or more challenging.*

- **P-Factor:** Propeller-driven planes pull to the left when flown at high power and low speed, as when taking off. You can set this to *Easy, Realistic,* or anywhere in between. When it's set to *Realistic,* you will need to use right rudder to counter the p-factor effect.

Tip *Setting the global* Realism *setting to* Easy *or* Medium *will leave the* Display Flying Tips *box checked. These helpful tips will appear during various stages of flight to offer instruction or help correct a problem—for example, letting you know your engine was just turned off and how to turn it back on!*

- **Torque:** This adjusts the effect of *propeller torque* on prop planes, which, like p-factor, adds to a left-turning tendency.
- **Gyro:** The heavy, fast-turning prop becomes in effect a gyroscope, which will resist any change in the direction of its rotating axis. The most detectable effect is when changing direction. For example, in a sudden *pitch up,* the gyro action on the prop will try to turn the plane.
- **Crash Tolerance:** Here you can adjust the likelihood that violent maneuvers or impacts will lead to a crash. Set it to *Realistic* for more challenging and unforgiving landings.
- **Pilot Controls Aircraft Lights:** You can toggle the control aircraft lights automatically or manually. This means you can control the aircraft's lights (landing light, navigation lights) or let the computer handle the task.

- **Gyro Drift:** This toggles the addition of *gyroscopic precession* in the *heading indicator*. Gyroscopic precession is the reaction of a gyroscope when force is applied to the spinning wheel. When this force is applied, the gyro reacts as if the force had been applied at a point 90 degrees from the point of actual application (in the direction of rotation). Since propellers act like gyros, gyroscopic precession affects propellers, causing the heading indicator to drift, over time. The addition of gyroscopic precession increases difficulty.
- **Display true or indicated airspeed:** Toggle either setting to display the aircraft's true or indicated airspeed.
- **Aircraft Stress Causes Damage:** You must check *Detect Crashes and Damage* to enable this setting, which allows damage to the aircraft during stressful maneuvers or landing.
- **Allow Collisions with Other Aircraft:** Again, check *Detect Crashes and Damage* to enable this setting, which activates collision detection with other aircraft.
- **Enable Automixture:** You can toggle *automixture* on or off. When it's on, the proper piston-engine fuel mixture is set automatically according to flight conditions.
- **Unlimited Fuel:** This toggles unlimited fuel on and off.

Tip *A novice* Flight Simulator *pilot, or one just looking to enjoy a sightseeing experience, should toggle the* Unlimited Fuel *option. With unlimited fuel, you won't have to worry about finding an airport, and can enjoy hours of uninterrupted flight and sightseeing. Once you're more adept at landing, or want a greater challenge, toggle off* Unlimited Fuel.

- **G-Effects:** Toggle this on to simulate physiological G-force effects, such as blackout or "redout," during stressful aircraft maneuvers.
- **Sun Glare:** Toggle this on to simulate glare when you're facing the sun.
- **Autorudder:** This toggle switch enables automatic coordination of your rudder and your ailerons.

Adjust the global *Realism* setting to automatically put each individual realism setting at the appropriate level. The following table reveals the preset global *Realism* settings.

Table 1.4: Preset *Realism* Settings

SETTING	EASY	MEDIUM	HARD
P-Factor	Easy (0%)	Medium (50%)	Realistic (100%)
Torque	Easy (0%)	Medium (50%)	Realistic (100%)
Gyro	Easy (0%)	Medium (50%)	Realistic (100%)
Crash Tolerance	Easy (0%)	Medium (50%)	Realistic (100%)
Pilot Controls Aircraft Lights	Off	Off	On

SETTING	EASY	MEDIUM	HARD
Gyro Drift	Off	Off	Off
Aircraft Stress Causes Damage	Off	Off	On
Allow Collisions with Other Aircraft	Off	Off	On
Enable Automixture	On	On	Off
Unlimited Fuel	On	Off	Off
G-Effects	Off	Off	On
Sun Glare	Off	Off	On
Autorudder	On	On	On

Controlling Your Flight Simulator

Both novice and advanced users can enhance their enjoyment of *Flight Simulator 2004: A Century of Flight* with controllers: joysticks, yokes, and rudder pedals. This section provides suggestions, information, and links regarding controllers.

Your choice of *Flight Simulator* controller might depend on your level of experience and what you expect *FS 2004* to deliver. A novice flight enthusiast, content with sightseeing and the wonder of flight, might be content with a mouse-and-keyboard setup, or a standard game pad or joystick.

However, more experienced players looking for the most realistic experience possible should seek out a more sophisticated controller. The beauty of *Flight Simulator* is that the experience can become as realistic as you wish, and your choice of controller has a significant impact on that realism (see Figure 1.7).

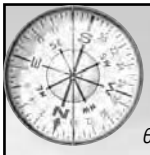
Tip *Although a joystick or a sophisticated controller will likely provide a more realistic flight experience, you can still control your* Flight Simulator *with the mouse and keyboard alone. Check out Appendix C for a complete keyboard reference table. Also consult the Learning Center sections "Using the Mouse" and "Using the Keyboard" for more information on using each controller, including tips on* remapping *keystrokes, and using the mouse to adjust cockpit panel knobs. But those seeking maximum realism should eschew the keyboard and invest in a flight yoke and rudder pedals, as discussed in this section.*

A joystick is a versatile controller that can be used for *FS 2004* and many other simulations and games. At the time of this writing, Microsoft offered three joysticks in their Sidewinder product line. You can find more specific information on Microsoft's Sidewinder joystick homepage, at http://www.microsoft.com/hardware/sidewinder/Joysticks.asp.

Although even the most basic joystick offers a more realistic flight experience than any mouse, it's best to select a joystick that provides rudder control. For instance, Microsoft's Precision 2 (http://www.microsoft.com/hardware/sidewinder/Prec2.asp) features a rotating

handle, for rudder control in flight. The Precision 2 also includes a 146-degree throttle, which can be mapped to the plane's throttle; a programmable eight-way hat switch, typically used to switch views; and 16 programmable buttons, which can be mapped to a variety of functions, including opening the kneeboard, adjusting flaps, lowering landing gear, or activating the GPS.

Microsoft's Force Feedback 2 (http://www.microsoft.com/hardware/sidewinder/FFB2.asp) has all the accoutrements of the Precision 2, but also includes *force feedback,* which gives the pilot tactile, realistic responses from the simulator *through the controller.* You'll feel realistic forces and responses to particular actions (for instance, back-pressure during takeoff) on the stick as you move the controls.



Tip *You can enable or disable several* force-feedback *options within the simulator.* Control Surface *forces are general, realistic forces such as those felt through the stick on takeoff and landing;* Stick Shaker *determines whether or not your stick will rattle if you exceed maximum speed in a jet;* Crash *effects send feedback to the stick in a crash;* Ground Bumps *are what you feel when you're rolling across the ramp, taxiway, or runway; and* Retractable Gear Thumps *are those thumps you feel when you retract the landing gear. You can disable all these pushes and thumps by deselecting the* Enable Force Feedback *option.*

More advanced users, or those looking for an even more realistic flight experience, should consider a flight *yoke,* such as the Flight Sim Yoke USB offered by CH Products (http://www.chproducts.com/retail/usb_flight_sim.html). The flight yoke resembles the control mechanism of many modern airplanes and offers the same customizable features as a joystick. CH Products' Flight Sim Yoke boasts a throttle lever, propeller lever, mixture lever, and 20 button functions, including the eight-way hat switch, a two-way gear switch, a two-way flaps switch, and two two-way rocket switches. A cheaper, but less feature-packed, LE version of the controller is available, as is a gameport (instead of USB connection) version.

A perfect addition to the flight yoke—and equally advanced—is the Pro Pedals USB also offered by CH Products (http://www.chproducts.com/retail/usb_pro_pedals.html). These rudder pedals, like those on an actual aircraft, are used to control rudder input and braking control. Like the flight yoke, Pro Pedals also is offered in a gameport version if you don't have a USB connection. You cannot mix USB devices with gameport devices, so consult your computer manual to ensure the availability of USB ports.

Both flight yokes and rudder pedals can greatly enhance your *Flight Simulator* experience, but might be a hefty investment for a more casual flight enthusiast. Your choice of controller should reflect the amount of realism and education you wish to receive from *Flight Simulator 2004: A Century of Flight*. Any control method, once you're comfortable, can provide an enormous amount of enjoyment. But the more advanced controllers provide a sense of realism above and beyond that which your mouse and keyboard, or even a standard joystick, can offer.

Troubleshooting Controller Issues

This section was written by Dean Bielanowski, Editor of *Computer Pilot Magazine: The Magazine for Desktop Pilots and Flight Simulator Enthusiasts.* This 84-page print magazine is published monthly by PC Aviator Inc. For more information, visit *Computer Pilot* online at http://www.computerpilot.com.

Dean has a broad knowledge of the many versions of Microsoft *Flight Simulator,* and has written extensively about the simulator and its development. He has provided technical support on simulator issues for many years. Educated in the medical field, Dean has written also for various medical publications. He has successfully translated his love for writing, aviation simulation, and information-sharing into a full-time job in the flight-simulation industry.

"I have a problem with my controller!"

There is nothing more frustrating to virtual pilots than a controller problem. It is a serious issue. Imagine what would happen if your control yoke suddenly decided to stop working in the middle of a real flight! You would be in a spot of bother, to say the least. So when you fire up your *Flight Simulator* and discover that your controls are not responding the way they should, or not responding at all, you have a problem.

Before you turn yourself inside out with frustration, or jump on the phone to the retailer from whom you bought your control device, take a step back and think about the problem. Solving control issues with *Flight Simulator* is really not that hard. There are simply a few rules, or points that you need to know about, which will likely solve most controller problems. Let's look at a few of the most common *Flight Simulator* control problems, and discuss some likely solutions.

Scenario 1: "My controller does not work at all."

My "day job" involves handling tech-support issues, and I can tell you now that this particular line seems to spring up all the time. Most often in this scenario, the controller itself is working fine. The problem lies either with the connection or configuration of the product itself.

First, make sure you've read the manuals that come with your control device. Many a problem has been outlined, and steps to solving it given, in product manuals. I will admit that reading manuals is not a whole lot of fun, but when you have a problem, this is the first place to look for an answer.

Ok, you've read through the manual, but it doesn't have the answer to your problem. Now we must do some investigating of our own. First, make sure the controller is plugged into the computer. It's a no-brainer, but sometimes they are not connected correctly or have worked their way loose. You must also ensure that the gameport or USB port to which your controller is connected is configured and working. Explanation of this is beyond the scope of this discussion.

All controllers need software drivers to operate. Manufacturers usually supply drivers for the device out of the box, but it's always a good idea to check for the latest drivers on the manufacturer's Web site, or contact them by phone to verify that the drivers you have are up to date. You must also have the correct drivers for your *operating* system. Later versions of Microsoft Windows might have drivers for your controller already available in the default driver database. The drivers should load automatically upon connection of your controller to the computer. Be sure to follow any specific instructions for installation provided by the manufacturer, and be aware that not all controllers will work on all versions of Microsoft Windows. Make sure your controller is compatible with your version of Windows.

Tip *The Learning Center also offers tips on configuring your controller. Read the section titled "Joysticks, Yokes, Throttles, and Pedals."*

Once you have verified that the controller is connected correctly and that the drivers have been loading, go to Windows Control Panel (Start/Settings/Control Panel) and look for the application named *Gaming Options* or *Game Controllers.* Double-click to open this application. The Game Controllers box opens (see Figure 1.7).

Figure 1.7: *The* Game Controllers *application in Windows, showing currently installed control devices*

If your controller is correctly connected and installed, it should now appear in this window with the status assignment of *OK.* If the status is *Not Connected,* then there is a connection and/or driver issue, and Windows is not correctly reading the device, in which case you should go back over the previous steps. (Also, consider trying your controller on a second system, as it is always possible that the controller itself *is* defective.)

If your device is *OK,* highlight it in the list and then click the *Properties* button in the lower right corner. This will open a new window with a *Test Screen* (see Figure 1.8). Move your controller about on all axes and test all buttons. They should correspond with the various button lights and axes columns and the crosshair box onscreen. If not, try calibrating the controller by using the *Settings* tab at the top of the window.

If you have a gameport-type controller and find that your crosshair or any other axis is jumping around wildly or is not controllable, it could be that your gameport itself is not up to speed. Some gameports cannot handle some of the later gameport controllers, so you

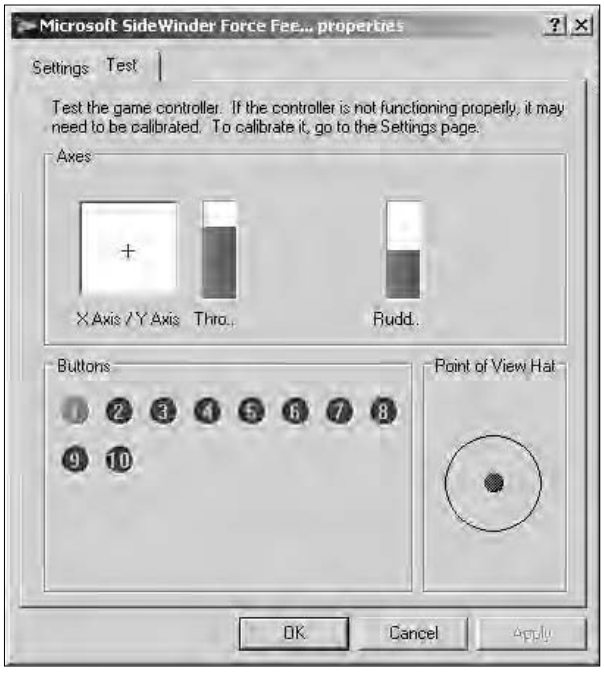


Figure 1.8: *Testing the selected controller*

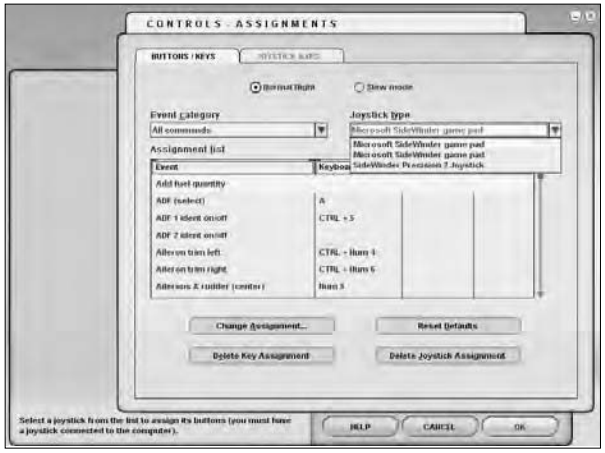


Figure 1.9: *The* Controls - Assignments *screen in* Flight Simulator 2004

should consider a new, or faster, gameport if you have exhausted all other options. USB controllers don't tend to suffer this problem as much, but it can sometimes occur if you are running your controller through a USB hub. If so, try connecting it directly to a USB port on the back of the motherboard/case.

Very important: You must have your controller listed in the Game Controllers box, with the status *OK,* and testing correctly in *Properties,* if you are to have any success using your controller within Microsoft *Flight Simulator 2004*. You should also remove any devices in the list that you do not use.

Once you have successfully navigated the above scenario, you can load up *Flight Simulator* and assign functions to your controller.

Scenario 2: "My controller lists within Windows, and tests just fine, but the buttons and axes do not do what I want within *Flight Simulator*."

In this case, go first to the *Control Options* screens within *Flight Simulator 2004*. Check the drop-down controllers list to make sure your device is actually listed (see Figure 1.9). If so, then your problem is likely to be simply a case of functions not being assigned to your liking, or not assigned at all!

Flight Simulator allows you to set up your controller's axes and buttons and hat switches just the way you like them. There are hundreds of aircraft functions that can be assigned to buttons to make your life easier. Check the online help system or manuals included with *Flight Simulator* to learn how to assign functions to your controller.

Scenario 3: "I have rudder pedals and a joystick, and when I slide the pedals back and forth, they actually control the throttle."

Again, this is simply a case of mis-assigned functions. To remedy this, go to *FS 2004's Controls - Assignments* section and select the *pedals* from the drop-down list. Next search the *assignments* list for the *throttle* axis and delete that assignment. You would then switch to *joystick/yoke* in the drop-down controllers list and re-assign the throttle to the *throttle wheel/axis* on your joystick or flight yoke. Again, check the *Help* section regarding controllers and function assignments.

Scenario 4: "My controller is fine when I start *Flight Simulator,* but at random times in my flight, my controller just stops working!"

While there are many potential reasons for this, I have noted that it's most commonly caused by the computer system not having enough power to maintain all the devices connected to it. With today's ultra-fast processors, video cards and technology, your computer needs a high-rating power supply to keep it all going at full speed without problems. While a 250 W power supply may get you going, I say *the more the better.* I recommend at least a 350 W power supply in a high-end system. There are other factors, of course....

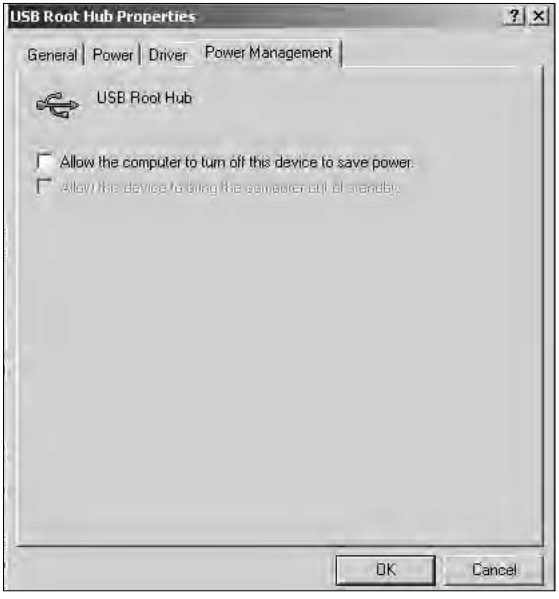


Figure 1.10: *Restrict the power-management features of Windows XP, so your gaming* experience *is not restricted!*

If you are using Microsoft Windows XP, there is a power-management function built into it that will disable certain devices if power consumption exceeds power supply. This is often the cause of controller "dropouts," particularly involving USB devices. In this case, you need to go to *Start/Settings/Control Panel/System/Hardware/Device Manager,* then open the *Universal Serial Bus* option. Within this option should be one or several listings called *USB Root Hub*. Highlight one at a time. Right-click on it, go to *Properties*, and then to the *Power Management* tab at the top of the smaller window that pops up. Find the option that says *Allow computer to turn off this device to save power,* or something similar, and un-check it. In other words, we do *not* want the computer to turn off this device to save power (see Figure 1.10).

If you are running your controller through a USB Hub, you might also like to

try connecting it directly to the USB ports on the motherboard or case, instead. Some controllers simply do not like to work through hubs.

Scenario 5: "My controller shows up fine in Windows, and tests *OK,* but *Flight Simulator* will not recognize it."

This was a small problem for some users in *FS 2000* and *FS 2002*. If anyone should have the same problem with *Flight Simulator 2004,* we can tell you that the fix that worked 95 percent of the time was to use the C*alibrate* button within the *Control Settings* screens to force *Flight Simulator* to detect the installed controllers.

Well, folks, there we have it! While this section does not cover every controller issue you may face, these are the five most common ones I have come across in my experience handling technical issues for users of *Flight Simulator.* I hope the suggestions contained here help you solve your controller issues, should you experience any. I cannot stress enough, however, the importance of reading any manuals that come with your specific game device. They are included for a reason, so exercise some common sense and read through them before you lose all the hair on your head through frustration!

Let me finish by making some suggestions for those readers who may be considering buying a new controller for *Flight Simulator 2004*. While *gameport* controllers are probably cheaper, and widely available, second-hand, I do not recommend them. They are being phased out as USB takes over. There is decreasing support for gameport controllers in today's market. The technology itself is basically "old hat," and you are likely to suffer more problems with gameport controllers than with the more modern USB-type devices. If you are buying new, go for USB.

Flight Simulator 2004 supports multiple control inputs, so even if you already have a gameport device, you also can hook up a USB device, and they can work together within *Flight Simulator.* (You assign functions to them as separate controllers.) This assumes that your gameport device can work on its own, directly through the gameport, and doesn't require direct hookup to another device.

Flight yokes are good, and add an extra touch of realism to the simulator (unless of course you are flying a later model Airbus aircraft), and rudder pedals make crosswind takeoffs and landings—and even taxiing—so much easier.

Ancillary devices such as avionics units and instruments made specifically for *Flight Simulator* (or that are compatible with it) are a good investment if you have the money, but may connect and operate differently, or require custom software for their configuration or use. We would all love full-motion, full-sized replica flight decks for our simulators, but most of us have to make do with what is in our budgets. At the end of the day, a solid simulator with working controls is an experience in itself.

CHAPTER 2
Modern Aircraft Reference

The aircraft, with their different characteristics, are the heart and soul of a flight simulator. **Flight Simulator 2004: A Century of Flight** ***offers its pilots 14 expertly modeled modern planes and helicopters, in addition to an exciting set of nine historical aircraft.*** **A Century of Flight*'s Learning Center provides ample background information, statistics, and flight notes on each craft.***

Important highlights of those statistics and flight notes, along with further insight and flying tips for each aircraft, have been compiled for this reference section. This chapter includes specifications, critical speeds, and flying tips for the **modern** ***aircraft at your command in*** **Flight Simulator 2004: A Century of Flight.**

Statistics Explained

We'll begin with explanations of the terms and abbreviations you'll find throughout this chapter. In "Specifications" we define various vital statistics, including measurements, speeds, and weights. "*V-speeds*" (velocity speeds) are used to designate maximum or minimum speeds during specific flight conditions. V-speeds, specific to each aircraft, inform pilots of an aircraft's abilities and limitations. And the "Measurements" section defines the common abbreviations for measurements that you'll encounter throughout this chapter and in Chapter 3: "Historical Aircraft Reference."

Note *For a complete step-by-step checklist for each modern aircraft, see Appendix B. Use these checklists in conjunction with the condensed flight tips throughout this chapter to ensure proper procedure.*

Specifications

Each of the following is an important specification, with a key application to flight.

- **Cruise Speed:** Average speed of an aircraft during straight-and-level flight at normal power settings.
- **Maximum Speed:** Maximum speed of the aircraft.
- **Maximum Range:** Range of the aircraft as a factor of cruise speed and fuel capacity at normal power settings.
- **Service Ceiling:** The altitude above sea level beyond which an airplane can no longer climb more than 100 feet per minute.
- **Fuel Capacity:** The maximum fuel capacity for the aircraft. This is certainly an important statistic if you choose to turn off the *Unlimited Fuel* option.
- **Maximum Takeoff Weight:** Approximate total flight simulator aircraft weight with full fuel and payload.
- **Length:** The length of the aircraft from nose to tail, in feet and inches.
- **Height:** The height of the aircraft from bottom to top, in feet and inches.
- **Wingspan:** The length of the aircraft's wingspan, in feet and inches.
- **Rotor Span:** Applicable to helicopters only. This is the length of the rotary blade, in feet and inches.
- **Useful Load:** Maximum takeoff weight minus basic operating weight (weight of aircraft plus operators).
- **Cargo Capacity:** Total cargo capacity of the aircraft, in cubic feet.
- **Engine:** The type of engine in the aircraft.
- **Propeller:** The type of propeller the aircraft uses.
- **Seating:** The number of seats that can be configured in the aircraft.

V-Speeds

The following table defines various v-speed abbreviations. The table does not include all real-world v-speeds, but instead focuses on the specific v-speeds compiled in the *FS 2004* aircraft database.

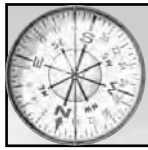
Tip *VREF, or the landing approach speed (based on weight and conditions), is generally 1.3 times VSO, or the plane's stall speed in landing configuration.*

Table 2.1: Velocity Speed Definitions

V-SPEED	DEFINITION
VA	Design maneuvering speed: the maximum speed at which full control deflection can be made without overstressing the aircraft.
VFE	Maximum flap-extended speed: the maximum allowable speed with the flaps extended.
VLE	Maximum landing gear-extended speed: the maximum allowable speed with the landing gear extended.
VLO	Maximum landing gear-operating speed: the maximum speed at which the landing gear can be extended or retracted.
VMC	Minimum control speed: the lowest speed at which the airplane is controllable when one engine is inoperative and the other engine is operating at full power.
VMO	Maximum operating limit speed: the speed that cannot be exceeded in any flight condition. VMO is expressed in KIAS (Knots Indicated Air Speed).
MMO	Maximum operating limit speed: the speed that cannot be exceeded in any flight condition. MMO is expressed in Mach number.
VNE	Never-exceed speed (the red line on the airspeed indicator).
VR	Rotation speed: the speed at which the pilot raises the nose to lift off the runway during the takeoff roll.
VREF	Approach speed (based on weight and conditions).
VS	Stalling speed: the minimum steady flight speed at which the aircraft is controllable.
VSO	Stalling speed: the minimum steady flight speed in the landing configuration.
VX (SE is single engine)	Best angle-of-climb speed: the speed at which the aircraft will gain the most altitude in the least horizontal distance.
VY (SE is single engine)	Best rate-of-climb speed: the speed at which the aircraft will gain the most altitude in the least amount of time.
V1	Takeoff decision speed: the speed at which it may not be possible to stop the aircraft on the runway in case of a rejected takeoff.
V2	Minimum takeoff safety speed: the minimum safe flying speed should an engine fail immediately after takeoff.
Turbulent Air Penetration Speed	Recommended airspeed for turbulent air. When the aircraft can structurally handle the design maneuvering speed. The maximum allowable airspeed in turbulent air (the lower limit of the yellow arc on the airspeed indicator).
Best Glide Speed	The airspeed that produces the maximum horizontal glide distance.

Measurements

The following table defines the measurement abbreviations used in the modern aircraft specifications tables presented throughout this chapter.



Tip *Need to convert specific measurements, like how fast 110 knots is, in miles per hour? Use the valuable Web site http://www.onlineconversions.com. There you can find conversion calculations for distances, speeds, and weights.*

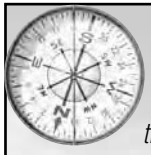
Table 2.2: Measurements Legend

ABBREVIATION	DEFINITION
bhp	Brake Horsepower
ft	Feet
gal	Gallons
hp	Horsepower
in	Inches
kg	Kilograms
KIAS	Knots Indicated Air Speed
km	Kilometers
kph	Kilometers per hour
kts	Knots
L	Liters
lb	Pounds
m	Meters
mi	Miles
mph	Miles per hour
nm	Nautical Miles
shp	Shaft Horsepower

Beechcraft Baron 58

Table 2.3: Beechcraft Baron 58 Specifications

ITEM	U.S.	METRIC
Cruise Speed	200 kts	370 kph
Maximum Range	1,569 nm	2,906 km
Service Ceiling	20,688 ft	6,306 km
Fuel Capacity	142 gal	514 L
Maximum Takeoff Weight	5,524 lb	2,509 kg
Length	29 ft, 10 in	9.09 m
Wingspan	37 ft, 10 in	11.53 m
Height	9 ft, 9 in	2.97
Useful Load	1,634 lb	741 kg



Tip *Fans of the Beechcraft Baron 58 should check out Beechcraft's official homepage for the Baron 58 at http://www.beechcraft.de/En/Neu_B58.htm. The site features exterior, interior, and cockpit photos, additional performance details, and equipment lists. Need a new paint job? Consider this "Christmas" theme repaint for the Baron 58 within FSPlanet.com's extensive file database: http://www.fsplanet.com/26122001.htm.*

ITEM	U.S.	METRIC
Engine	Teledyne Continental Motors IO-550-C 300 hp	
Propeller	Three-bladed McCauley Constant-Speed Variable Pitch	
Seating	Up to Six	
Total Flight Simulator aircraft weight with full fuel	5,500 lb	

Table 2.4: Beechcraft Baron 58 V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	156 KIAS
VLO – Maximum Gear Operating Speed	152 KIAS
VLE – Maximum Landing Gear Extension Speed	152 KIAS
Turbulent Air Penetration Speed	156 KIAS
VNE – Never-Exceed Speed	223 KIAS
VS – Stalling Speed (Max. Weight)	84 KIAS
VSO – Stalling Speed in Landing Configuration	75 KIAS
VX – Two-Engine Best Angle-of-Climb Speed	92 KIAS
VY – Two-Engine Best Rate-of-Climb Speed	105 KIAS
VREF – Landing Approach Speed (5,400 lb)	95 KIAS (Full Down—Flaps 30)
VXSE – Single-Engine Best Angle-of-Climb Speed	100 KIAS
VYSE – Single-Engine Best Rate-of-Climb Speed	101 KIAS
VMC – Minimum Control Speed	84 KIAS
VY – Two-Engine Best Rate-of-Climb Speed	105 KIAS
Best Glide Range Speed	115 KIAS
VFE – Maximum Flaps Extended Speed	152 KIAS (Approach—Flaps 15) 122 KIAS (Full Down—Flaps 30)

Flying Tips

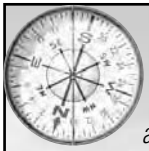
The flying tips provided in this chapter are a quick reference for each aircraft. They use the default keyboard reference, so if you've remapped keystrokes, the instructions will differ than those presented in this chapter. For further detailed flight instruction, consult the "Flight Notes" in the aircraft section of the Learning Center or each aircraft's specific checklist in Appendix B.

Many factors affect flight planning and aircraft operation, including aircraft weight, weather, and runway surface. The recommended flight parameters in this chapter are intended to give approximations for flights at maximum takeoff (full fuel and payload) or landing weight, on a day with International Standard Atmosphere (ISA) conditions, established as a baseline for calculations used in meteorology, aviation, and aerodynamics. A set of standard conditions exists for each altitude. For instance, at sea level, standard conditions are defined as 29.92 inches of mercury (1,013 millibars) and 59 degrees Fahrenheit (15 degrees Celsius).

Beechcraft Baron 58 Flying Tips

Note *The runway length required for both takeoff and landing is a result of a number of factors, including aircraft weight, altitude, headwind, use of flaps, and ambient temperature. Lower weights and temperatures will result in better performance, as will a headwind. Higher altitudes and temperatures will degrade performance.*

- **Required Runway Length:** 2,200 feet with ISA conditions. 3,800 feet with a 50-foot obstacle.
- **Taxiing:** Set propeller (Ctrl + F3 until fully forward) and mixture (Ctrl + Shift + F3 until fully forward) to full forward, and adjust power (F3 as necessary) enough to begin the Baron 58 moving.
- **Takeoff:** Align the aircraft with the white runway centerline and advance the throttle to full (F3 until fully forward). Lift off at approximately 85 KIAS.
- **Ascent:** Climb at approximately 105 knots (2,700 rpm using Ctrl + F3 and Ctrl + F2 to set propeller as necessary). Maintain a 10 degrees pitch attitude to climb to cruising altitude.
- **Descent:** Reduce airspeed to 170–175 knots for a comfortable descent rate of 500 feet per minute. Adjust power to approximately 20" of manifold pressure (F2 as necessary) and propeller speed to 2,300 rpm (Ctrl + F2 as necessary).
- **Landing:** Adjust flaps (F6 and F7 as necessary) as you descend. When airspeed reaches 152 knots or less, set flaps to *approach* (15 degrees). Extend full flaps (30 degrees) at 122 knots or below.



Developer's Tip *In a Baron 58, I fly a faster approach speed of between 110 and 120 knots (120 on an instrument approach with gear down and flaps in approach setting). I'll slow to above 95 crossing the threshold (the numbers on the runway) once I know the tires are going to touch the pavement. An approach speed of 95 knots (approach, not landing) is slow. 1.3 * VSO is 97+ knots and you don't want to be below this. When ready for landing, slowing to just above 95 is okay.*

➢ **Touchdown:** At the threshold, establish normal landing speed at approximately 95 KIAS. Bring the power back to 13" of manifold pressure (F2 as necessary) and raise the nose slightly to *flare* upon touchdown. Once down, lightly apply the brakes (Period key) and use the rudder for directional control off of the runway.

➢ **Power Settings**: The following table reveals appropriate manifold pressure and RPM settings for various phases of flight for the Baron 58.

Table 2.5: Beechcraft Baron 58 Power Settings

PHASE OF FLIGHT	MANIFOLD PRESSURE (MP)	ENGINE SPEED (RPM)	FLAPS	GEAR	TARGET AIRSPEED	OTHER
Takeoff	Full	Full (2,700)	Up	Down	Rotate at 95–100 kts	
Initial Climb	Full	Full (2,700)	Up	Up	Climb at 140 kts	10-Degree Pitch and 1,500 fpm Climb
Climb	25"	2,500	Up	Up	155 kts	Once you're above "Safe Altitude" (500–1,000 ft above Airport), and in Normal Cruise, Climb 5-Degree Pitch and ~800 fpm
Cruise	25" (Max Cruise) 23" (Mid-Range) 21" (Economy)	2,500 (Max Cruise) 2,300 (Mid-Range) 2,100 (Economy)	Up	Up	170 kts	
Cruise Descent	18" 20"	2,300 2,300	Up	Up	180 kts 175 kts	1,000 fpm 500 fpm
Maneuvering for Approach or in Pattern	18" 18" 20"	2,300 2,300 2,300	Up Approach	Up Down	155 kts 120 kts 110 kts	Level
Approach – Final (Precision)	17"	2,300	Approach	Down	120 kts	~700 fpm Descent
Short Final (Runway in Sight)	15" Reducing to 12"	Full	Full	Down	100 kts Slowing for Touchdown	Grease It On!

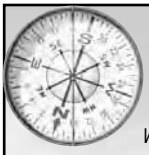
Beechcraft King Air 350

Table 2.6: Beechcraft King Air 350 Specifications

ITEM	U.S.	METRIC
Cruise Speed	315 kts (363 mph)	583 kph
Maximum Range	1,765 nm VFR, 1,582 nm IFR	3,509 km
Service Ceiling	35,000 ft	10,688 m
Fuel Capacity	539 gal	2,040 L
Maximum Takeoff Weight	15,000 lb	6,818 kg
Length	46.7 ft	14.23 m
Wingspan	57.9 ft	17.65 m
Height	14.3 ft	4.36 m
Useful Load	5,810 lb	2,635 kg
Engine	Pratt & Whitney PT6A-60A 1,050 shp	
Seating	Up to 11	
Total Flight Simulator aircraft weight with full fuel	14,922 lb	

Table 2.7: Beechcraft King Air 350 V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VMO – Maximum Operating Speed (airspeed)	263 KIAS
MMO – Maximum Operating Speed (Mach)	.58 Mach
Turbulent Air Penetration Speed	170 KIAS
V1 – Takeoff Decision Speed (Dry Runway, Flaps Up, 5,000 ft. Pressure Altitude, Standard Temperature)	108 KIAS (15,000 lb) 104 KIAS (< 10,500 lb)
V2 – Takeoff Safety Speed (Dry Runway, Flaps Up, 5,000 ft. Pressure Altitude, Standard Temperature)	117 KIAS (15,000 lb) 111 KIAS (< 10,500 lb)
VA – Maneuvering Speed	184 KIAS
VFE – Maximum Flaps Extended Speed	202 KIAS (Approach) 158 KIAS (Fully Down)



Tip *Those seeking more info on the Beechcraft King Air 350 should take a look at Beechcraft's official homepage for the King Air 350, at http://www.beechcraft.de/En/Neu_350.htm. The site offers exterior, interior, and cockpit photos, additional performance details, and equipment lists. Serious about training with the King Air 350? Flight Deck Solutions sells a complete King Air 350 panel kit. Visit http://www.flightdecksolutions.com/Nova/KingAir/KA35packages.htm and check out the screenshot, In Action with* Flight Simulator*, at http://www.flightdecksolutions.com/images/Nova/kingair/front-15-03.JPG.*

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VLE – Maximum Landing Gear Extension Speed	184 KIAS
VLO – Maximum Gear Operating Speed	184 KIAS (Extension) 166 KIAS (Retraction)
VMC – Air Minimum Control Speed	94 KIAS (Flaps Up) 93 KIAS (Flaps Approach)
VR – Rotation Speed (Dry Runway, Flaps Up, 5,000 ft. Pressure Altitude, Standard Temperature)	111 KIAS (15,000 lb) 104 KIAS (< 10,500 lb)
VREF – Landing Approach Speed (Flaps Down, Gear Down)	109 KIAS (15,000 lb) 105 KIAS (14,000 lb) 102 KIAS (13,000 lb) 100 KIAS (12,000 lb) 100 KIAS (11,000 lb) 100 KIAS (10,000 lb)
VX – Best Angle of Climb (Two Engines)	125 KIAS
VY – Best Rate of Climb (Two Engines)	140 KIAS
Cruise Climb	170 KIAS (Sea Level to 10,000 ft) 160 KIAS (10,000–15,000 ft) 150 KIAS (15,000–20,000 ft) 140 KIAS (20,000–25,000 ft) 130 KIAS (25,000–30,000 ft) 120 KIAS (35,000–40,000 ft)
Best Glide Speed, Both Engines Inoperative	135 KIAS
VFE – Maximum Flaps Extended Speed	202 KIAS (Approach) 158 KIAS (Full Extension)

Beechcraft King Air 350 Flying Tips

- **Required Runway Length:** 4,193 feet for takeoff with flaps up. 3,300 feet for landing with approach flaps extended. These figures assume a weight of 15,000 lb, a sea-level altitude, no headwind, a temperature of 15 degrees Celsius, and a hard surface runway.
- **Taxiing:** The normal power setting for taxiing is the *Ground Fine* setting (F2 as necessary). For normal operation on the ground, maintain an rpm above 1,050 (Ctrl + F2 or Ctrl + F3 as necessary).

WARNING

The "Flying Tips" section of this modern aircraft reference chapter is intended for use with Flight Simulator 2004: A Century of Flight *only. Apply these to your virtual flying experience only. These quick reference tips are not a substitute for a real aircraft manual for use in real-world flight!*

- **Takeoff:** No-flaps takeoff is standard for the King Air. When you're aligned on the runway, check that the propeller levers are full forward (Ctrl + Shift + F3 until fully forward) and the condition levers are in *Low Idle.* Advance power levers to 100 percent (F3 as necessary). Maintain directional control with rudders. Lift off at approximately 110 KIAS, raising the nose to 10 degrees above horizon. Maintain 117 KIAS (at maximum weight) until clear of obstacles. When a positive rate of climb is established, retract the landing gear (G).
- **Ascent:** Set climb power to approximately 90 percent (F2 or F3 as necessary). Set the propeller rpm to 1,600 (Ctrl + F2 or Ctrl + F3 as necessary). Maintain a six-to-seven degree nose-up pitch attitude to climb to cruising altitude. Adjust power to maintain 170 KIAS from sea level to 10,000 ft, 160 KIAS from 10,000 ft to 15,000 ft, 150 KIAS from 15,000 ft to 20,000 ft, 140 KIAS from 20,000 to 25,000 ft, 130 KIAS from 25,000 ft to 30,000 ft, and 120 KIAS from 35,000 ft to 40,000 ft.
- **Descent:** Adjust power during descent to maintain 250 KIAS (F2 or F3 as necessary). Propeller should remain at 1,500 rpm (Ctrl + F2 or Ctrl + F3 as necessary). Nearing approach phase, reduce power to 55 percent and below 180 KIAS. At final approach, reduce power to 30 percent and slow to 140 KIAS. Verify that autofeather is armed.
- **Landing:** Intercept the glide slope, set the flaps to *approach* (F7 until *approach*) and set landing gear down (G). Bring power back to 25 percent. Adjust power to target landing speed of 109 KIAS at maximum weight. Set flaps to full (F7) once landing is assured. At 50 feet, power should be at 10 percent.
- **Touchdown:** Raise the nose slightly to flare. Once down, bring power down (F2 as necessary) and apply back-pressure on the controls (King Air nose tends to start down right away). Move propeller levers to bottom of *Ground Fine* range (F2 until fully out). On short-field landing, move propeller levers into *Reverse* once nose gear is on ground. Apply brakes (Period key), move propeller to *Ground Fine,* exit the runway, and taxi to parking.
- **Power Settings**: The following table reveals appropriate manifold pressure and RPM settings for various phases of flight for the King Air 350.

Table 2.8: King Air 350 Power Settings Table

PHASE OF FLIGHT	TORQUE (THROTTLE)	ENGINE SPEED (RPM)	FLAPS	GEAR	TARGET AIRSPEED	OTHER
Takeoff	Full (100% N1)	Full (1,700)	Up Approach	Down	Rotate: 113 kts Rotate: 107 kts	13,700–14,000 lb, Initial Pitch Up 10–12 Degrees. Flaps Up at 125 kts
Climb (to 10,000 ft) (10,000–20,000 ft) (20,000–25,000 ft) (25,000–35,000 ft)	90% N1 90% N1 90% N1 90% N1	1,600 1,600 1,600 1,600	Up	Up	160 kts 140 kts 130 kts 120 kts	Initial 8- to 10-Degree Pitch Up. Once at "Safe Altitude" (1,000 ft above Airport), 12-Degree Pitch Up

PHASE OF FLIGHT	TORQUE (THROTTLE)	ENGINE SPEED (RPM)	FLAPS	GEAR	TARGET AIRSPEED	OTHER
Cruise Cruise Descent	90% N1 90% N1	1,500 1,500	Up Up	Up Up	- Max 250 kts	- -2 to -3 Degrees Pitch Down; 1,500 fpm Descent Level
Maneuvering for Approach or in Pattern	45% N1 35% N1 47% N1 55% N1	1,500 1,500 1,500 1,500	Clean Approach	Up Down	175 kts 160 kts 140 kts 135 kts	
Approach – Final (Precision)	40% N1 36% N1	1,600	Approach Full	Down	140 kts 120–125 kts (Minimum VREF +15)	~700 fpm Descent
Short Final (Runway in Sight, Landing Assured)	25% Reducing to 15% N1	Full	Full	Down	105 kts (VREF) Slowing for Touchdown	Grease It On!

Bell 206B JetRanger

Table 2.9: Bell 206B JetRanger Specifications

ITEM	U.S.	METRIC
Cruise Speed	115 kts (132 mph)	213 kph
Maximum Range	435 nm	805 km
Service Ceiling	20,000 ft	6,096 m
Hovering Ceiling	19,600 ft	5,974 m
Fuel Capacity	91 gal	344 L
Empty Weight	1,640 lb	744 kg
Maximum Gross Weight	3,200 lb	1,451 kg

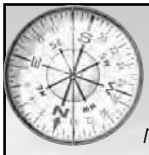
(continued on next page)

Table 2.9: Bell 206B JetRanger Specifications ***(continued from previous page)***

ITEM	U.S.	METRIC
Maximum Gross Weight (External Loading)	3,350 lb	1,519 kg
Length	31.2 ft	9.51 m
Rotor Span	33.3 ft	10.15 m
Height	11.7 ft	3.51 m
Useful Load	1,498 lb	679 kg
Engine	Allison 250-C20J 420 shp	
Seating	Up to Five	
Total Flight Simulator aircraft weight with full fuel	2,700 lb	

Table 2.10: Bell 206B JetRanger V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VNE – Never Exceed Speed (< 3,000 lb, Sea Level–3,000 ft. Density Altitude; Decrease 3.5 KIAS per Thousand Feet Above 3,000)	130 KIAS
VNE – Never Exceed Speed (> 3,000 lb, Sea Level–3,000 ft. Density Altitude; Decrease 7.0 KIAS per Thousand Feet Above 3,000)	122 KIAS
Maximum Autorotation Speed	100 KIAS
Maximum Autorotation Glide Speed	69 KIAS
Minimum Autorotation Descent Speed	52 KIAS
Maximum Rate of Climb	52 KIAS

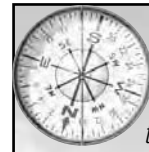


Tip *If you're interested in learning more about Bell Helicopter's 206B series and other Bell helicopters, visit Bell Helicopter's official homepage for the 206B series at http://www.bellhelicopter.com/aircraft/commercial/bell206b-3.html. The page includes product specs, mission applications, customizing options, and a photo gallery.*

Bell 206B JetRanger Flying Tips

- **Required Runway Length:** It's simply the length of the JetRanger's landing skids! The Bell 206B JetRanger can land on buildings, in small open clearings, and virtually anywhere, except on water.
- **Hover-Taxiing:** Used when you need to move the helicopter a short distance, akin to taxiing in an airplane. Given typical weather conditions and operating weights, apply 70–75 percent torque to hover-taxi.

- **Takeoff:** If possible, plan to take off directly into the wind to minimize sideways drift and increase the helicopter's performance. Ensure cyclic pressure is *neutral* and set collective to *full down* (F2 until *down*). Slowly raise the collective (F3 as necessary) to 50 percent torque and continue slowly up to 60 percent, where you should notice the helicopter lifting off of the ground. If the helicopter drifts to the right, use left cyclic pressure (left on the controller) to hold position. Continue to smoothly increase the collective to continue the liftoff. Apply forward pressure on the controller to lower the nose, and begin moving forward along the departure path.



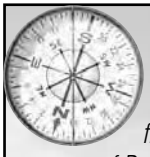
Tip *Controlling a helicopter is more about finesse than sheer force. Apply gentle cyclic, directional pressure at all times so you remain in control of the aircraft. Too much pressure one way and you may have to apply too much opposite pressure to compensate—and soon you're out of control. Begin with gentle pressure, compensate with gentle pressure, and end with gentle pressure.*

- **Ascent:** The JetRanger can climb at a maximum rate of approximately 1,300 feet per minute (at sea level under standard weather conditions). Best rate-of-climb speed is 52 knots, though 60 knots is a good climb speed because it's also the speed for autorotation if the engine fails. Adjust the collective (F3 as necessary) to 10 percent more than what is required to maintain a hover—typically 80–85 percent for a normal climb. Expect torque to drop 3 percent per thousand feet of altitude gained.
- **Descent:** Like an ascent, decrease the collective (F2 as necessary) gradually to maintain a controlled descent. Expect torque to increase 3 percent per thousand feet of altitude lost. The helicopter's nose will also drop as you decrease torque, so pull back gently on the control as needed. As you near the approach, don't descend faster than 300 feet per minute.
- **Landing:** Keep an eye on your landing area at all times. If you're landing in the bush, make sure the landing area is wide enough to accommodate the rotor blades. A descent angle of 10–12 degrees provides good obstacle clearance and helps keep the landing area in sight. Adjust the collective (F2 or F3 as necessary) to increase or decrease rate of descent.
- **Touchdown:** Plan a three-foot hover over the landing spot for a soft landing. Increase collective (F3 as necessary) to slow descent as you near the landing spot. If you begin to rise, carefully decrease collective (F2 as necessary). Apply gentle control pressure if needed. Once you are hovering, lower the collective slowly to settle onto the landing spot. When the helicopter is down (completely!) lower the collective all the way (F1).

Boeing 737-400

Table 2.11: Boeing 737-400 Specifications

ITEM	U.S.	METRIC
Cruise Speed	477 kts (550 mph)	885 kph
Maximum Range	2,059 nm	3,810 km
Service Ceiling	36,089 ft	11,000 m
Fuel Capacity	5,311 gal	20,104 L
Empty Weight – Standard	76,180 lb	34,550 kg
Maximum Takeoff Weight	138,500 lb	62,800 kg
Length	120 ft	36.45 m
Wingspan	94 ft, 9 in	25.9 m
Height	36.5 ft	11.13 m



Tip *Fans of Boeing should read more about the Boeing's 737 line, including its next generation, at Boeing's official homepage for the 737 at http://www.boeing.com/commercial/737family/flash.html. Boeing employees gathered on December 15, 1999 at the facility in Renton, Washington, to cast off the final Boeing 737-400 and the last production of the Boeing "Classic" series. This plane, and the gathering of Boeing employees, can be seen in this photo: http://avstop.com/news/R11ts.jpg.*

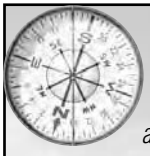
ITEM	U.S.	METRIC
Cargo Capacity	1,373 cubic ft	38.9 cubic m
Engine	CFM56-3C1	
Seating	147–168	
Total Flight Simulator Aircraft Weight with Full Fuel	135,844 lb	

Table 2.12: Boeing 737-400 V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VMO – Maximum Operating Speed (airspeed)	340 KIAS
MMO – Maximum Operating Speed (Mach)	.82 Mach
Turbulent Air Penetration Speed	280 KIAS / .73 Mach
VLO – Maximum Gear Operating Speed	235 KIAS
VLE – Maximum Leading Gear Extension Speed	270 KIAS / .82 Mach
VFE – Maximum Flap Extended Speeds	Flaps 1: 230 KIAS Flaps 2: 230 KIAS Flaps 5: 225 KIAS Flaps 10: 210 KIAS Flaps 15: 195 KIAS Flaps 25: 190 KIAS Flaps 30: 185 KIAS Flaps 40: 158 KIAS
V1 – Takeoff Decision Speed (Dry Runway, Flaps 5)	Standard Temperature, Sea-Level Pressure Altitude 150 KIAS (143,000 lb) 143 KIAS (132,000 lb) Standard Temperature, 5,000 ft. Pressure Altitude 152 KIAS (143,000 lb) 145 KIAS (132,000 lb)
VR – Rotation Speed (Dry Runway, Flaps 5)	Standard Temperature, Sea-Level Pressure Altitude 154 KIAS (143,000 lb) 147 KIAS (132,000 lb) Standard Temperature, 5,000 ft. Pressure Altitude 157 KIAS (143,000 lb) 149 KIAS (132,000 lb)
V2 – Takeoff Safety Speed (Dry Runway, Flaps 5)	Standard Temperature, Sea-Level Pressure Altitude 162 KIAS (143,000 lb) 155 KIAS (132,000 lb) Standard Temperature, 5,000 ft. Pressure Altitude 161 KIAS (143,000 lb) 155 KIAS (132,000 lb)
VREF – Landing Approach Speed (Flaps 30, Gear Down)	147 KIAS (136,400 lb) 144 KIAS (132,000 lb)

Boeing 737-400 Flying Tips

- **Required Runway Length:** 5,500 feet for takeoff with flaps at 5 degrees. 5,500 feet for landing with flaps at 30 degrees. These figures assume a weight of 138,500 lb, a sea-level altitude, no headwind, and a temperature of 15 degrees Celsius.
- **Taxiing:** *Idle* thrust is adequate for taxiing under most conditions but you'll need a slightly higher thrust setting to get the aircraft rolling (F2 or F3 as necessary). Response to thrust change is slow, so allow time for each change before altering thrust again. Use rudders for directional control during taxiing. Avoid stopping the 737 during turns, as excessive thrust will be required to get moving again.
- **Takeoff:** Set flaps to *5* (F7 as necessary). Align with runway centerline and advance throttle to approximately 40 percent (F2 or F3 as necessary). As engines stabilize to symmetrical thrust (around 60 KIAS), advance power to near 100 percent (F2 or F3 as necessary). Lift off at approximately 143 KIAS and raise nose to 10 degrees above horizon. Retract landing gear (G) when climbing. Expect aircraft to accelerate to approximately 165–170 KIAS. At 1,000 feet, reduce flaps from *5* to *1* (F6 as necessary). Continue to 210 KIAS; at that point, you can go to flaps *up* (F6 as necessary) at approximately 3,000 feet.
- **Ascent:** Set climb power to approximately 90 percent (F2 or F3 as necessary). Maintain six-to-seven degrees nose-up pitch attitude to climb at 250 knots (the maximum speed below 10,000 feet), from 3,000 feet until you reach 10,000 feet (climbing at approximately 800 fpm). Maintain 280 KIAS at cruise altitude above 10,000 feet.
- **Descent:** Reduce power to *idle* and lower nose slightly (a degree or two). Don't exceed 250 KIAS below 10,000 feet. It takes about 35 seconds and 3 miles (5.5 km) to decelerate from 290 KIAS to 250 KIAS in level flight without speed brakes. It takes another 35 seconds to slow to 210 KIAS.



Tip *In the 737-400, plan to arrive at traffic-pattern altitude, at the flaps-up maneuvering speed, about 12 miles out when landing straight-in, or about eight miles out when entering a downwind approach. A good crosscheck is to be at 10,000 ft (3,048 m) when you're 30 miles (55.5 km) from the airport at 250 KIAS.*

- **Landing:** Set flaps to *1* (F7 as necessary) when airspeed is reduced below the minimum flaps-up maneuvering speed. Continue adding flaps (F7 as necessary) as you get down to the speed limits for each setting. *Flaps 30* is the normal landing setting. Extend landing gear (G) when glide slope needle is less than or equal to one dot high. Final approach speed for typical operating weight is 135–140 KIAS. Set power to 55–60 percent (F2 or F3 as necessary). Your desired (goal) descent rate is 700 feet per minute. Place the speed brake handle into *ARM* position (Shift + /).

- **Touchdown:** When the aircraft's main wheels are about 15 feet above the runway, flare the nose up about three degrees. Adjust power to *idle* (F2 or F3 as necessary). Apply brakes (Period key) smoothly once the main gear touches down. Move brake lever to *up* (/) unless spoilers were armed. Add *reverse thrust* (F2 until *reverse*) but come out of reverse thrust when airspeed drops below 60 knots, and return to *idle* speed (F3 until *idle*).
- **Flaps Reference:** The following table lists recommended maneuvering speeds for various flap settings. These are the minimums for flap operation. Adding 15–20 knots to these speeds is recommended if you are maneuvering with large bank angles.

Table 2.13: Boeing 737-400 Recommended Speeds for Flap Settings

FLAP POSITION	< 1/2 FUEL	> 1/2 FUEL
Flaps Up	210 KIAS	220 KIAS
Flaps 1	190 KIAS	220 KIAS
Flaps 5	170 KIAS	180 KIAS
Flaps 10	160 KIAS	170 KIAS
Flaps 15	150 KIAS	160 KIAS
Flaps 25	140 KIAS	150 KIAS

Boeing 747-400

Table 2.14: Boeing 747-400 Specifications

ITEM	U.S.	METRIC
Cruise Speed	565 mph (.85 Mach)	910 kph
Maximum Range	7,325 nm	13,570 km
Maximum Certified Operating Altitude	45,100 ft	13,747 m
Fuel Capacity	57,285 gal	216,840 L
Basic Operating Weight	403,486 lb	182,020 kg
Length	231 ft, 10 in	70.6 m
Wingspan	211 ft, 5 in	64.4 m
Height	63 ft, 8 in	19.4 m
Engine	Pratt & Whitney PW4062: 63,300 lb Rolls Royce RB211-524H: 59,500 lb General Electric CF6-80C2B5F: 62,100 lb	
Seating	Typical 3-class Configuration – Up to 416 Typical 2-class Configuration – Up to 524 Typical 1-class Configuration – N/A	
Total Flight Simulator aircraft weight with full fuel	824,861 lb	

Table 2.15: Boeing 747-400 V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VMO – Maximum Operating Speed (airspeed)	355 KIAS
MMO – Maximum Operating Speed (Mach)	.88 Mach
Turbulent Air Penetration Speed	280 KIAS / .73 Mach
VLO – Maximum Landing Gear Operating Speed	270 KIAS / .82 Mach
VLE – Maximum Leading Gear Extended Speed	270 KIAS / .82 Mach
VFE – Maximum Flap Extended Speeds	Flaps 1: 280 KIAS Flaps 5: 260 KIAS Flaps 10: 240 KIAS Flaps 20: 230 KIAS Flaps 25: 205 KIAS Flaps 30: 180 KIAS

Tip *If you're interested in reading more about the Boeing's 747-400, visit Boeing's official homepage for the 747 family at http://www.boeing.com/commercial/747family/flash.html. Here you'll find background info, technical specs, and a collection of videos and photos.*

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
V1 – Takeoff Decision Speed (Dry Runway)	Standard Temperature, Sea-Level Pressure Altitude 160 KIAS (880,000 lb, Flaps 10) 155 KIAS (880,000 lb, Flaps 20) Standard Temperature, 5,000 ft. Pressure Altitude 163 KIAS (880,000 lb, Flaps 10) 158 KIAS (880,000 lb, Flaps 20)
VR – Rotation Speed (Dry Runway)	Standard Temperature, Sea-Level Pressure Altitude 177 KIAS (880,000 lb, Flaps 10) 171 KIAS (880,000 lb, Flaps 20) Standard Temperature, 5,000 ft. Pressure Altitude 179 KIAS (880,000 lb, Flaps 10) 173 KIAS (880,000 lb, Flaps 20)
V2 – Minimum Climb Speed (Dry Runway)	Standard Temperature, Sea-Level Pressure Altitude 188 KIAS (880,000 lb, Flaps 10) 181 KIAS (880,000 lb, Flaps 20) Standard Temperature, 5,000 ft. Pressure Altitude 188 KIAS (880,000 lb, Flaps 10) 181 KIAS (880,000 lb, Flaps 20)
VREF – Landing Approach Speed	188 KIAS (850,000 lb, Flaps 25, Gear Down) 181 KIAS (850,000 lb, Flaps 30, Gear Down) 134 KIAS (450,000 lb, Flaps 25, Gear Down) 129 KIAS (450,000 lb, Flaps 30, Gear Down)

Boeing 747-400 Flying Tips

- **Required Runway Length:** 10,561 feet for takeoff with flaps at 5 degrees. 7,870 feet for landing with flaps at 30 degrees.
- **Taxiing:** Maximum taxi weight is 853,000 lb. Don't use *reverse thrust* to taxi. *Idle thrust* is adequate for taxiing under most conditions (F2 or F3 as necessary) but you'll need a slightly higher thrust setting to get the aircraft rolling. Response to thrust change is slow, so allow time for each change before altering thrust again. Straight taxi speed should not exceed 20 knots; for turns, eight to 12 knots is good for dry surfaces. Use rudders for directional control during taxiing. Avoid stopping the 747 during turns, as excessive thrust will be required to get moving again.
- **Takeoff:** Set flaps to *5* (F7 as necessary). Align with runway centerline and advance throttle to approximately 40 percent (F3). As engines stabilize to symmetrical thrust (around 60 KIAS), advance throttle to near 100 percent (F3 as necessary). Lift off at approximately 177 KIAS and raise nose to 10 degrees above horizon. Retract landing gear (G) once climbing. Expect aircraft to accelerate to approximately 200 KIAS. At 1,000 feet, reduce flaps from *5* to *1* (F6). Continue to 200 KIAS; at that point, you can go to flaps *up* (F6).

➢ **Ascent:** Set climb power to approximately 90 percent (F2 or F3 as necessary). Maintain six-to-seven degrees nose-up pitch attitude to climb at 250 knots until you reach 10,000 feet, then climb at 340 knots to 25,000 feet, then .84 Mach to cruise altitude.

Tip *Use the "rule of three" when planning your descent in the 747-400 (and other aircraft). Here's how it works: Take your cruise altitude and subtract your destination's altitude (e.g. 20,000 – 1,000 equals 19,000). Divide the result by 1,000, and multiply by three (19,000/1,000 = 19 x 3 = 57). The result is how many nautical miles from your destination to begin your descent. At what* rate *should you descend? Check your ground speed (e.g. 150 KIAS), divide by two (150/2 = 75), and multiply by 10 (75 x 10 = 750). That's your descent rate in feet per minute. For more on descents and descent calculations, see Chapter 7, "Approaches and Landings."*

➢ **Descent:** Reduce power to *idle* (F2) and lower nose slightly (a degree or two). Don't exceed 250 KIAS below 10,000 feet. It takes about 35 seconds and 3 miles (5.5 km) to decelerate from 290 KIAS to 250 KIAS in level flight without speed brakes. It takes another 35 seconds to slow to 210 KIAS. Follow the same traffic-pattern altitude procedures as described for the 737-400.

➢ **Landing:** Set flaps to *1* (F7) when airspeed is reduced below the minimum flaps-up maneuvering speed. Continue adding flaps as you get down to the speed limits for each setting. *Flaps 30* (F7) is normal landing setting. Extend landing gear (G) when the glideslope needle is less than, or equal to, one dot high. Final approach speed for typical operating weight is 135–140 KIAS. Set power to 55–60 percent (F2 or F3 as necessary). Goal descent rate is 700 feet per minute. Place speed brake handle into *ARM* position (Shift + /).

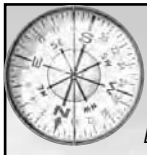
➢ **Touchdown:** Maximum landing weight is 630,000 lb. When your aircraft's main wheels are about 15 feet above the runway, flare the nose up about three degrees. Adjust your power to *idle* (F2 or F3 as necessary). Apply brakes (Period key) smoothly once the main gear touches down. Move the brake lever to *up* (/) unless the spoilers were armed. Add *reverse thrust* (F2 until *reverse*), but come out of reverse thrust when airspeed drops below 60 knots (F2 until idle).

➢ **Flaps Reference:** The following table recommends maneuvering speeds for various flap settings. These are minimums for flap operation. Adding 15–20 knots to these speeds is recommended if maneuvering at large bank angles.

Table 2.16: Boeing 747-400 Recommended Speeds for Flap Settings

FLAP POSITION	< 1/2 FUEL	> 1/2 FUEL
Flaps Up	210 KIAS	220 KIAS
Flaps 1	190 KIAS	220 KIAS
Flaps 5	170 KIAS	180 KIAS
Flaps 10	160 KIAS	170 KIAS
Flaps 15	150 KIAS	160 KIAS
Flaps 25	140 KIAS	150 KIAS

Boeing 777-300



Tip *FSPlanet.com offers many repaints for the Boeing 777-300. Customize your 777-300 by starting at http://www.fsplanet.com/31122001.htm, in their file database. Here you'll find 777-300 repaints with Air France, Continental, and a Delta variation. Further information, technical specs, photos, and videos of Boeing's 777-300 can be found at Boeing's official homepage for the 777 family at http://www.boeing.com/commercial/777family/flash.html.*

Table 2.17: Boeing 777-300 Specifications

ITEM	U.S.	METRIC
Cruise Speed	555 mph (.84 Mach)	893 kph
Maximum Range	5,960 nm	11,038 km
Maximum Operating Altitude	43,100 ft	13,137 m
Typical Cruising Altitude	35,000 ft	10,688 m
Fuel Capacity	45,200 gal	171,160 L
Maximum Takeoff Weight – Basic	660,000 lb	299,370 kg
Length	242 ft, 4 in	73.9 m
Wingspan	199 ft, 11 in	60.9 m
Height	60 ft, 8 in	18.5 m
Cargo Capacity	7,552 cubic ft	213.8 cubic m
Engine	P&W 4000, RR Trent 800, or GE 90 Series	
Seating	386–550	
Configurations	Seating ranges from six to 10 abreast with two aisles	
Total Flight Simulator aircraft weight with full fuel	580,069 lb	

Table 2.18: Boeing 777-300 V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VMO – Maximum Operating Speed (airspeed)	330 KIAS
MMO – Maximum Operating Speed (Mach)	.84 Mach
Turbulent Air Penetration Speed	280 KIAS / .84 Mach
VLO – Maximum Gear Operating Speed	270 KIAS / .82 Mach
VLE – Maximum Landing Gear Extension Speed	270 KIAS / .82 Mach
VFE – Maximum Flap Extended Speeds	Flaps 1: 255 KIAS Flaps 5: 235 KIAS Flaps 15: 215 KIAS Flaps 20: 200 KIAS Flaps 25: 190 KIAS Flaps 30: 180 KIAS
V1 – Takeoff Decision Speed (Dry Runway)	Standard Temperature, Sea-Level Pressure Altitude 153 KIAS (580,000 lb) Standard Temperature, 3,000 ft. Pressure Altitude 154 KIAS (580,000 lb)

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VR – Rotation Speed (Dry Runway, Flaps 5)	Standard Temperature, Sea-Level Pressure Altitude 156 KIAS (580,000 lb) Standard Temperature, 3,000 ft. Pressure Altitude 157 KIAS (580,000 lb)
V2 – Minimum Climb Speed (Dry Runway, Flaps 5)	Standard Temperature, Sea-Level Pressure Altitude 162 KIAS (580,000 lb) Standard Temperature, 3,000 ft. Pressure Altitude 162 KIAS (580,000 lb)
VREF – Landing Approach Speed (Flaps 30, Gear Down)	157 KIAS (580,000 lb)

Boeing 777-300 Flying Tips

- **Required Runway Length:** 11,000 feet for takeoff with flaps at 5 degrees. 11,000 feet for landing with flaps at 30 degrees. These figures assume a weight of 550,000 lb, a sea-level altitude, no headwind, and a temperature of 15 degrees Celsius.
- **Taxiing:** Don't use reverse thrust to taxi. Allow plane to accelerate at *idle*. Gently apply power to get rolling (F3 as necessary). Once rolling, return to *idle* (F2). Avoid taxi speeds greater than 30 knots. If you exceed 30 knots, brake (Period key) to 10 knots, then release the brakes to return speed to near 30 knots at *idle*. Use rudders for directional control during taxiing. Avoid stopping during turns, as excessive thrust will be required to get moving again.

Tip *One real-world pilot's technique for taxiing onto a runway in the 777 is to taxi toward the opposite side of the runway until his seat is over the grass on the far side. Then he turns the tiller (nose gear steering) hard, so that the nose comes around to the runway centerline.*

- **Takeoff:** Set flaps to *5* (F7). Align with runway and advance throttle to 1.85 on the engine pressure-ratio gauge (F3 as necessary). As the engines stabilize to symmetrical thrust (at around 60 KIAS), advance power to near 100 percent (F3 as necessary). Lift off at approximately 153 KIAS and raise the nose to 10 degrees above the horizon. Retract landing gear (G) once climbing. Expect the aircraft to accelerate to approximately 175–180 KIAS. At 1,000 feet, reduce flaps from *5* to *1* (F6). Continue to 210 KIAS; at that point, you can go to flaps *up* (F6).
- **Ascent:** Reduce power to 95 percent (F2 as necessary) and climb at 250 KIAS to 10,000 feet. Then lower the nose as required to accelerate to 320 KIAS (F2 or F3 as necessary) until reaching .76 Mach.
- **Descent:** Reduce power to *idle* (F2 as necessary) and lower the nose slightly (a degree or two) to maintain a speed of .84 Mach until you reach 310 KIAS. Since you're descending, you can maintain speed with less power. Maintain 270 KIAS during your descent (use pitch to adjust your airspeed). This will provide a descent rate of about 1,800–2,000 fpm. Plan to be at 10,000 feet about 20 miles from the airport. You must be at or below 250 KIAS by this point. At 15 miles, reduce your speed to below 220 KIAS and go to flaps *1* (F7).

- **Landing:** When you're about 10 miles from touchdown, go to flaps *15* (F7 as necessary) and a speed of 165 KIAS. Extend the landing gear (G) once the glide slope comes alive. Go to *Flaps 20* (F7 as necessary), arm the *speed brakes* (Shift + /) and set the *auto-brakes.* As you start down the glide slope, go to *Flaps 30* (F7 as necessary) and adjust power to maintain a final approach speed of 140 KIAS (F2 or F3 as necessary). As you cross the threshold at around 50 feet, bring power to *idle* (F2 as necessary).
- **Touchdown:** When the aircraft's main wheels are about 15 feet above the runway, flare the nose up no more than three degrees. Once you're down, pull the *thrust levers* into *reverse* (F2 until *reverse*). Go to *idle* once you reach 60 knots (F3 until idle). Brake to taxi speed of 30 knots. Retract flaps (F6) and lower spoilers (/).

Cessna C172SP Skyhawk

Tip *More information—including additional specifications, interior and exterior features, and an instrument panel overview—on the Skyhawk SP can be found at Cessna's official homepage for the Skyhawk SP at http://skyhawksp.cessna.com/.*

Table 2.19: Cessna C172SP Skyhawk Specifications

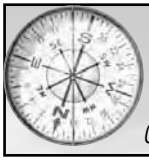
ITEM	U.S.	METRIC
Maximum Speed	126 kts	234 kph
Cruise Speed	124 kts	230 kph
Maximum Range	638 nm	1,183 km
Service Ceiling	14,000 ft	4,267 m
Fuel Capacity	56 gal	212 L
Empty Weight	1,665 lb	1,002 kg
Maximum Gross Weight	2,550 lb	1,157 kg
Length	27 ft, 2 in	8.2 m
Wingspan	36 ft, 1 in	11 m
Height	8 ft, 11 in	2.72 m
Engine	Textron Lycoming IO-360-L2A 180 bhp	
Propeller	Macauley Fixed Pitch Two Blade	
Seating	Up to Four	
Total Flight Simulator Aircraft Weight with Full Fuel	2,550 lb	

Table 2.20: Cessna C172SP Skyhawk V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	105 KIAS (2,550 lb) 98 KIAS (2,200 lb) 90 KIAS (1,900 lb)
VFE – Maximum Flaps-Extended Speed	110 KIAS (Flaps 10) 85 KIAS (Flaps 15–30)
VN – Maximum Structural Cruising Speed	129 KIAS
VNE – Never Exceed Speed	163 KIAS
VS – Stalling Speed (Max. Weight, Flaps Up)	48 KIAS
VSO – Stalling Speed in the Landing Configuration (Maximum Weight, Flaps 30)	40 KIAS
VX – Best Angle-of-Climb Speed	62 KIAS (Sea Level) 67 KIAS (10,000 ft)
VY – Best Rate-of-Climb Speed	74 KIAS (Sea Level) 72 KIAS (10,000 ft)
Best Glide Speed	68 KIAS

Cessna C172SP Skyhawk Flying Tips

- **Required Runway Length:** 960 feet at sea level with ISA conditions.
- **Taxiing:** Power should be set at approximately 1,000 rpm (F2 or F3 as necessary). *Mixture* should be full forward (Ctrl + Shift + F3 until fully in). Use the rudder for directional control down the taxiway.
- **Takeoff:** Set flaps to either 0 degrees or 10 degrees (F7). (Setting flaps to 10 degrees reduces your takeoff roll by approximately 10 percent.) Align the aircraft with the white runway centerline and advance throttle control to full power (F3 until full). Lift off at approximately 55 KIAS and raise the nose to 10 degrees above the horizon.
- **Ascent:** Ideal climb speed should be 75–85 KIAS, full throttle (F3 until full) with no flaps (F7) and a fully rich mixture (Ctrl + Shift + F3 until fully in), all below 3,000 feet. Once above 3,000 feet, *lean* the mixture (Ctrl + Shift + F3, or Ctrl + Shift + F2, as necessary) for maximum rpm. Ideal cruise settings are between 45 percent and 75 percent power (F2 or F3 as necessary), at an rpm between 2,100 and 2,700.



Tip *Both Cessnas available in* FS 2004 *make excellent choices for airborne beginners and aspiring pilots looking to earn their "wings." The Student Flight Lessons available in the "Flying Lessons" section—covering the basics of straight and level flight, turns, takeoffs, and landings—are taught in a Cessna C172SP.*

- **Descent:** Set power to 2,100 rpm (F2 or F3 as necessary) and descend at approximately 450 fpm. Adjust mixture for smooth operation (Ctrl + Shift + F3 as necessary).
- **Landing:** Plan for a landing speed of 65 knots with full flaps (F7). Leave power at approximately 1,500 rpm (F2 or F3 as necessary).
- **Touchdown:** Reduce throttle completely (F2 until idle) and flare the nose (pull back on the controls slightly) just above the runway. Land on the back wheels first. With less than full flaps, expect a bit of *float* in the flare. After touchdown, apply brakes (Period key), exit the runway, and retract wing flaps (F6 as necessary).

Cessna C182S Skylane

Table 2.21: Cessna C182S Skylane Specifications

ITEM	U.S.	METRIC
Maximum Speed	145 kts (167 mph)	269 kph
Cruise Speed	140 kts (161 mph)	259 kph
Maximum Range	968 nm	1,519 km
Service Ceiling	18,100 ft	5,517 m
Fuel Capacity	92 gal	333 L
Empty Weight	1,910 lb	854 kg
Maximum Gross Weight	3,110 lb	1,411 kg

(continued on next page)

Tip *Build your own Cessna Skylane—an all-wood model, that is. Check out the Great Planes Model Manufacturing Company's Web site, at http://www.greatplanes.com/airplanes/gpma1228.html, for information on building your own Skylane. Rather read up on the real thing? Visit Cessna's official homepage for the Skylane at http://skylane.cessna.com/. This site has specifications, feature lists, and an image gallery.*

Table 2.21: Cessna C182S Skylane Specifications *(continued from previous page)*

ITEM	U.S.	METRIC
Length	29 ft	8.84 m
Wingspan	36 ft	11 m
Height	9 ft	2.77 m
Useful Load	1,200 lb	557 kg
Engine	Textron Lycoming IO-540-AB1A5 230 hp	
Propeller	Macauley Three-Bladed Constant Speed	
Seating	Up to Four	
Total Flight Simulator Aircraft Weight with Full Fuel	3,100 lb	

Table 2.22: Cessna C182S Skylane V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	110 KIAS (3,100 lb) 101 KIAS (2,600 lb) 88 KIAS (2,000 lb)
VFE – Maximum Flaps-Extended Speed	140 KIAS (Flaps 0-10) 120 KIAS (Flaps 10-20) 100 KIAS (Flaps 20-Full)
VNO – Maximum Structural-Cruising Speed	140 KIAS
VNE – Never Exceed Speed	175 KIAS
VS – Stalling Speed (Maximum Weight, Flaps Up)	40 KIAS
VSO – Stalling Speed in the Landing Configuration (Maximum Weight, Flaps Up)	35 KIAS
VX – Best Angle-of-Climb Speed	63 KIAS (Sea Level) 66 KIAS (10,000 ft)
VY – Best Rate-of-Climb Speed	80 KIAS (Sea Level) 72 KIAS (10,000 ft)
Best Glide Speed	75 KIAS

Cessna C182S Flying Tips

- **Required Runway Length:** 960 feet at sea level with ISA conditions.
- **Taxiing:** Power should be set at approximately 1,000 rpm (F2 or F3 as necessary). *Mixture* should be full forward (Ctrl + Shift + F3 until fully in). Use the rudder for directional control down the taxiway.

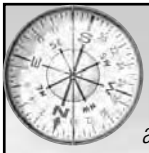
- **Takeoff:** Set flaps to either 0 or 20 degrees (F7). Align the aircraft on the runway and advance throttle control to full power (F3 until full). Lift off at 50–60 KIAS and raise the nose to 10 degrees above horizon.
- **Ascent:** Ideal climb speed should be 80 KIAS at sea level, full throttle (F3 until full) with no flaps (F7), and a fully rich mixture (Ctrl + Shift + F3 until fully in).
- **Descent:** Set power to 2,100 rpm (F2 or F3 as necessary) and descend at approximately 450 feet per minute. Adjust the mixture for smooth operation (Ctrl + Shift + F3 as necessary). If you extend flaps, note the maximum flaps-extended speeds in the v–speeds chart above.
- **Landing:** Plan for a landing speed of 60–70 knots with full flaps (F7). Leave power at approximately 1,500 rpm (F2 or F3 as necessary).
- **Touchdown:** Reduce throttle completely (F2 until idle) and flare the nose (pull back on controls slightly) just above the runway. Land on the back wheels first. With less than full flaps, expect a bit of *float* in the flare. After touchdown, apply the brakes (Period key), exit the runway, and retract your wing flaps (F6 as necessary).

Tip *Travis Faudree,* Flight Simulator *enthusiast, had this to say about flying the Cessna 182: An aircraft with a variable pitch (constant speed) propeller may seem exotic and intimidating to the inexperienced pilot. These systems, however, are quite user-friendly and efficient—as long as they're flown properly. The trick is to fly the aircraft in a* squared *condition, meaning that if the manifold pressure is set to 25—, the prop should be set to 2,500 rpm (note the* squared, *or matching, 25s). This is true for most aircraft, but you should always check the Pilot's Operating Handbook for each individual airplane. Go ahead and give it a shot in the C182, Mooney, or Baron.*

Cessna C208 Caravan Amphibian

Table 2.23: Cessna C208 Caravan Amphibian Specifications

ITEM	U.S.	METRIC
Maximum Speed	175 kts	324 kph
Cruise Speed	143 kts (8,000 lb) 130 kts (6,400 lb) 117 kts (5,200 lb)	265 kph (8,000 lb) 241 kph (6,400 lb) 217 kph (5,200 lb)
Service Ceiling	13,500 ft	4,115 m
Fuel Capacity	335 gal	1,268 L
Empty Weight	4,895 lb	2,220 kg
Maximum Gross Weight	8,035 lb	3,645 kg
Length	41 ft, 7 in	12.8 m
Wingspan	52 ft, 1 in	15.85 m
Height	15 ft, 5.5 in	4.7 m
Useful Load	3,140 lb	1,424 kg
Maximum Range	4.6 Hours, with Maximum Cruise at 10,000 ft 5.7 Hours, with Maximum Cruise at 20,000 ft 6.8 Hours, with Maximum Range at 10,000 ft 8.0 Hours, with Maximum Range at 20,000 ft	
Engine	Pratt & Whitney Canada, Inc., Free Turbine. Flat Rated at 675 shp PT6A–114A	
Propeller	McCauley Three–Bladed, Constant Speed, Full Feathering, Reversible, 106–inch diameter.	
Seating	Up to 14	
Total Flight Simulator Aircraft Weight with Full Fuel	8,000 lb	



Tip *If you're interested in reading more about the Caravan Amphibian series, visit Cessna's official homepage for the Caravan Amphibian at http://caravan.cessna.com/amphibian.chtml. Here you'll find details on its panel and equipment-configuration types, along with a photo gallery and even a screensaver.*

Table 2.24: Cessna C208 Caravan Amphibian V–Speeds

V–SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	143 KIAS (8,000 lb) 130 KIAS (6,400 lb) 117 KIAS (5,200 lb)
VMO – Maximum Operating Speed	175 KIAS
VNO – Maximum Structural Cruising Speed	140 KIAS
VS – Stalling Speed (maximum weight, flaps up)	65 KIAS
VSO – Stalling Speed in Landing Configuration (Maximum Weight, Flaps 30)	51 KIAS
VFE – Maximum Flaps Extended Speed	175 KIAS (Flaps 0–10) 150 KIAS (Flaps 10–20) 125 KIAS (Flaps 20–full)
VR – Rotation Speed	50–60 KIAS (On Water) 65–70 KIAS (On Land)
VX – Best Angle of Climb	81 KIAS (Sea Level)
VY – Best Rate of Climb	97 KIAS (Sea Level) 94 KIAS (10,000 ft) 85 KIAS (20,000 ft)
Cruise Climb	110–120 KIAS
Landing Approach Speed	95–105 KIAS (Flaps Up) 75–85 KIAS (Flaps 30)
Maximum Glide Speed	87 KIAS (8,000 lb) 78 KIAS (6,400 lb) 70 KIAS (5,200 lb)

Cessna C208 Caravan Amphibian Flying Tips

- **Required Runway Length:** 2,500 feet with ISA conditions.
- **Taxiing:** Water rudders should be *down* for taxiing on water and *up* for taxiing on land (Shift + 4). Landing-gear handle should be *up* on water and *down* on land (G as necessary). Propeller (Ctrl + F2 or Ctrl + F3 as necessary) and *mixture* (Ctrl + Shift + F3 until fully in) should be set to *full forward.*
- **Takeoff on Water:** Set flaps to 0–20 degrees, though 20 degrees is recommended (F6 or F7 as necessary). Set power to 1,900 rpm (F2 or F3 as necessary). Lift off at approximately 85–95 KIAS (with obstacles ahead, 80 KIAS). Retract flaps (F6 as necessary) after reaching 90 KIAS.
- **Takeoff on Land:** Set flaps to 10–20 degrees, with 20 degrees for a short field (F6 or F7 as necessary). Power set to 1,900 rpm (F2 or F3 as necessary). Lift off at approximately 80–95 KIAS (with obstacles ahead, 80 KIAS). Retract flaps (F6 as necessary) after reaching 90 KIAS. Retract landing gear once clear (G).

- **Ascent:** Set power to 1,600–1,900 rpm (Ctrl + F2 or Ctrl + F3 as necessary) for a climb speed of 110–120 KIAS. Final cruise speed at approximately 155 KIAS.
- **Descent to Water:** Landing gear *up* (G if necessary) and water rudders *up* (Shift + 4). Adjust flaps (F7 as necessary) to airspeed as desired: 0–10 degrees at less than 175 KIAS; 10–20 degrees at less than 150 KIAS; 20–30 degrees at less than 125 KIAS. Reduce airspeed to 75–85 KIAS with flaps down.

Tip *The Cessna C208 Caravan Amphibian is a favorite among bush pilots. To learn more about "bush flying" and tips on creating your own bush adventures—as well as a specific challenge for bush flying—flip to Chapter 8, "So You Want To Be A…"*

- **Descent:** Water rudders *up* (Shift + 4). Landing gear *up* if landing on water and *down* if landing on land (G if necessary). Adjust flaps (F7 as necessary) to airspeed as desired: 0–10 degrees at less than 175 KIAS; 10–20 degrees at less than 150 KIAS; 20–30 degrees at less than 125 KIAS.
- **Landing on Water:** Prepare for a landing speed of 75–85 KIAS with flaps down (F7 until down). Land at slightly tail low.
- **Landing on Land:** Prepare for a landing speed of 75–85 KIAS with flaps down (F7 until down). Land at slightly tail low.
- **Touchdown on Water:** Hold aft as the amphibian decelerates to taxi speed.
- **Touchdown on Land:** Ease forward to lower bow wheels gently to runway.

Cessna C208B Grand Caravan

Table 2.25: Cessna C208B Grand Caravan Specifications

ITEM	U.S.	METRIC
Maximum Speed	175 kts	324 kph
Cruise Speed	175 kts at 10,000 ft; 164 kts at 20,000 ft	324 kph at 10,000 ft; 305 kph at 20,000 ft
Service Ceiling	22,800 ft	6,950 m
Fuel Capacity	335 gal	1,268 L
Empty Weight	4,040 lb	1,830 kg
Maximum Gross Weight	8,785 lb	3,980 kg
Length	41 ft, 7 in	12.8 m
Wingspan	52 ft, 1 in	15.85 m
Height	15 ft, 5.5 in	4.7 m
Useful Load	4,745 lb	2,150 kg
Engine	Pratt & Whitney Canada, Inc., Free Turbine. Flat Rated at 675 shp PT6A-114A	
Propeller	McCauley Three-Bladed, Constant Speed, Full Feathering, Reversible, 106-inch Diameter	
Seating	Up to 14	
Total Flight Simulator Aircraft Weight with Full Fuel	8,750 lb	

Tip *If you're interested in reading more about the Grand Caravan series, visit Cessna's official home-page for the Grand Caravan at http://grandcaravan.cessna.com/. You'll find details on its performance, specifications, interior configurations, instrument panel and equipment, and a photo gallery. There's also a user-made Caravan resource on the web called Caravan Pilots. Check out http://www.caravanpilots.com/, which seeks to provide Caravan pilots with "a useful and functional exchange of experiences and information."*

Table 2.26: Cessna C208B Grand Caravan V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	148 KIAS (8,750 lb) 137 KIAS (7,500 lb) 112 KIAS (6,250 lb)
VMO – Maximum Operating Speed	175 KIAS
VNO – Maximum Structural Cruising Speed	140 KIAS
VNE – Never Exceed Speed	175 KIAS

(continued on next page)

Table 2.26: Cessna C208B Grand Caravan V-Speeds ***(continued from previous page)***

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VS – Stalling Speed (Maximum Weight, Flaps Up)	63 KIAS
VSO – Stalling Speed in Landing Configuration (Maximum Weight, Flaps 30)	50 KIAS
VFE – Maximum Flaps Extended Speed	175 KIAS (Flaps 0–10) 150 KIAS (Flaps 10–20) 125 KIAS (Flaps 20–full)
VR – Rotation Speed	70–75 KIAS
VX – Best Angle of Climb	72 KIAS
VY – Best Rate of Climb	104 KIAS (Sea Level–10,000 ft) 87 KIAS (20,000 ft)
Cruise Climb	110–120 KIAS
Landing Approach Speed	100–115 KIAS (Flaps Up) 75–85 KIAS (Flaps 30)
Maximum Glide Speed	95 KIAS (8,750 lb) 87 KIAS (7,500 lb) 79 KIAS (6,250 lb)

Cessna C208B Grand Caravan Flying Tips

- **Required Runway Length:** 2,500 feet with ISA conditions.
- **Taxiing:** Propeller (Ctrl + F2 or Ctrl + F3 as necessary) and mixture (Ctrl + Shift + F3 until fully in) should be set to *full forward.*
- **Takeoff:** Set flaps at 10–20 degrees with 20 degrees for short field (F6 or F7 as necessary). Power set to 1,900 rpm (F2 or F3 as necessary). Lift off at 80–95 KIAS (with obstacles ahead, 80 KIAS). Retract flaps (F6 as necessary) after reaching 90 KIAS. Retract landing gear once clear (G).
- **Ascent:** Set power to 1,600–1,900 rpm (Ctrl + F2 or Ctrl + F3 as necessary) for a climb speed of 110–120 KIAS. Your final cruise speed should be approximately 155 KIAS.
- **Descent:** Landing gear down (G if necessary) and water rudders *up* (Shift + 4). Adjust flaps (F7 as necessary) to airspeed as desired: 0–10 degrees at less than 175 KIAS; 10–20 degrees at less than 150 KIAS; 20–30 degrees at less than 125 KIAS.
- **Landing:** Prepare for a landing speed of 75–85 KIAS with flaps down (F7 until down). Land with tail slightly low.
- **Touchdown:** Ease forward to lower bow wheels gently to runway.

Extra 300S

Table 2.27: Extra 300S Specifications

ITEM	U.S.	METRIC
Maximum Speed	200 kts (230 mph)	370 kph
Cruise Speed	178 kts (205 mph)	330 kph
Maximum Range	415 nm (478 mi)	769 km
Service Ceiling	16,000 ft	4,877 m
Fuel Capacity	42.3 gal	160 L
Empty Weight	1,470 lb	667.8 kg
Maximum Gross Weight	2,095 lb	950 kg
Length	23.36 ft	7.12 m

(continued on next page)

Tip *The Extra 300S is also a popular RC—or remote-controlled—plane used by hobby enthusiasts. Searching the web reveals many hobby sites profiling the Extra 300S. To learn more about the Extra 300S and aerobatic flying, check out the Patty Wagstaff's Airshows Web site at http://www.aerobatic-source.com/pattywagstaff/planespecs.html.*

Table 2.27: Extra 300S Specifications *(continued from previous page)*

ITEM	U.S.	METRIC
Wingspan	26.25 ft	8 m
Height	8.6 ft	2.62 m
Useful Load	625 lb	283.5 kg
Engine	Textron Lycoming AEIO-540 L1B5 300 hp	
Propeller	Three-Bladed Constant Speed	
FFA Certified Load Factor	± 6 G (Normal[1]) ± 10 G (Aerobatic[2])	
Seating	One	
Total Flight Simulator Aircraft Weight with Full Fuel	8,750 lb	

1: Normal is 2,028 lb. 2: Aerobatic is 1,808 lb.

Table 2.28: Extra 300S V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	112 KIAS (6,250 lb) 140 KIAS (Normal[1]) 158 KIAS (Acrobatic[2])
VNO – Maximum Structural Cruising Speed	158 KIAS
VNE – Never Exceed Speed	220 KIAS
VS – Stalling Speed	59 KIAS (Normal[1]) 55 KIAS (Acrobatic[2])
VX – Best Angle-of-Climb Speed	93 KIAS (Normal[1]) 87 KIAS (Acrobatic[2])
VY – Best Rate-of-Climb Speed	104 KIAS (Normal[1]) 96 KIAS (Acrobatic[2])
Best Glide Speed	90 KIAS (Normal[1]) 80 KIAS (Acrobatic[2])

1: Normal is 2,028 lb. 2: Aerobatic is 1,808 lb.

Table 2.29: Extra 300S Recommended Aerobatic Maneuver Entry Speeds

MANEUVER	MINIMUM	MAXIMUM
Horizontal Line	VS	VNO
45-Degree Climbing	80 KIAS	VNO
90-Degree Up	158 KIAS	VNO
45-Degree Diving	VS	VNO
90-Degree Diving	VS	VNO
1/4 Loop Climb	100 KIAS	190 KIAS
Loop	100 KIAS	190 KIAS
Stall Turn	100 KIAS	190 KIAS
Aileron Roll	80 KIAS	158 KIAS
Snap Roll	80 KIAS	140 KIAS
Tail Slide	100 KIAS	190 KIAS
Spin	VS	VNE
Knife Edge	>150 KIAS	VNO
Inverted Flight	>VS	190 KIAS

Extra 300S Flying Tips

- **Required Runway Length:** 813 feet for takeoff and 1,798 feet for landing. These figures assume a weight of 2,095 lb, a sea-level altitude, no headwind, a temperature of 15 degrees Celsius, and a hard-surface runway.
- **Taxiing:** Power should be set at about 1,000 rpm (F6 or F7 as necessary). Propeller (Ctrl + F2 or Ctrl + F3 as necessary) and mixture (Ctrl + Shift + F3 until fully in) should be set to *full forward*. The Extra 300S is a *taildragger:* on the ground, the aircraft's nose is so high that it's difficult to see the taxiway and runway. Move in S-turns down the runway if necessary, so you can see out of the side windows. For more on taxiing in taildraggers, check out the "Taildragger Taxiing Tips" sidebar in the "Flying Taildraggers" section of the Learning Center.

Tip *For more on aerobatic flying in planes such as the Extra 300S, check out Chapter 8, "So You Want To Be A…" which offers tips on assuming a variety of roles, including* bush pilot, airline pilot, *and* aerobatic pilot.

- **Takeoff:** Align the aircraft with the runway centerline and advance the throttle to full power (F3 until fully in). Maintain a slight forward pressure on the controls and the tail will rise at about 40 KIAS. Ease back on the controls and the plane will become airborne at 65–70 KIAS.
- **Ascent:** If cruising cross-country, reduce power after takeoff to 26– of manifold pressure (F2 as necessary). Raise the nose and climb at around 100 KIAS. Though the Extra 300S isn't designed for long cross-country flights, expect 150 KIAS at typical cruise-power settings.
- **Descent:** Plan approach at 80 KIAS. Upon entering traffic pattern, reduce power to 15– of manifold pressure (F2 as necessary). Hold airspeed of 70 KIAS. If too low, add an inch or two of manifold pressure; if too high, reduce by an inch or two.
- **Landing:** Smoothly reduce power to *idle* and hold the nose slightly above the horizon. Allow the airplane to settle gently onto the runway—all three wheels simultaneously. This requires that the Extra 300S be in a nose-high attitude at touchdown.

Tip Flight Sim *enthusiast Dudley Henriques shared this tip about flying the Extra 300S: The Extra 300S is designed with* neutral stability, *which is a must in an aerobatic airplane. Basically, this means that when you make* bank *and* pitch *movements, using aileron and elevator, the Extra 300S will stay where you put it until you apply pressures in another direction—changing its position again.*

- **Touchdown:** Hold full back-pressure on the controls and apply minimum required brakes (Period key). If you touch down too hard, the nose-high attitude can cause the Extra 300S to bounce back into the air. If you bounce, apply full throttle (F3 until full) and then gently drop the plane back onto the runway. Exit the runway. For more on landing and touchdown in taildraggers, check out the "Landing" section in the "Flying Taildraggers" section of the Learning Center.

Learjet 45

Table 2.30: Learjet 45 Specifications

ITEM	U.S.	METRIC
Cruise Speed	464 kts (.81 Mach)	859 kph
Maximum Range	2,200 nm	4,074 km
Service Ceiling	51,000 ft	15,545 m
Fuel Capacity	904.8 gal	3,341 L
Maximum Gross Weight	20,450 lb	9,276 kg
Maximum Takeoff Weight	20,200 lb	9,163 kg
Length	58.4 ft	17.7 m
Wingspan	47.8 ft	14.6 m
Height	14.3 ft	4.3 m
Useful Load	2,650 lb	1,202 kg
Engine	Allied Signal TFE731-20 3,500 lb thrust	
Seating	Up to Nine	
Total Flight Simulator Aircraft Weight with Full Fuel	19,907 lb	

Table 2.31: Learjet 45 V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VMO – Maximum Operating Speed (Airspeed)	330 KIAS
MMO – Maximum Operating Speed (Mach)	.81 Mach (Autopilot Engaged)
VA – Maneuvering Speed	150 KIAS (Sea Level, 12,500 lb) 163 KIAS (20,000 ft, 12,500 lb) 195 KIAS (40,000 ft, 12,500 lb) 198 KIAS (Sea Level, 20,200 lb) 225 KIAS (20,000 ft, 20,200 lb) 245 KIAS (40,000 ft, 20,200 lb)
VLO – Maximum Gear Operating Speed	200 KIAS
VLE – Maximum Landing Gear Extension Speed	260 KIAS

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Tip *If you're interested in reading more about the Bombardier Learjet 45, visit Bombardier's official homepage for the Learjet 45 at http://www.bombardier.com/en/3_0/3_2/3_2_6/3_2_6.jsp?niveau1=6. There you can read about its cabin design, specifications, and technology. You also will find exterior, cockpit, and cabin photos; an informational video; and a fact sheet, as part of its multimedia section.*

Table 2.31: Learjet 45 V-Speeds ***(continued from previous page)***

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VFE – Maximum Flaps Extended Speed	250 KIAS (Flaps 8) 200 KIAS (Flaps 20) 150 KIAS (Flaps 40)
V1 – Takeoff Decision Speed (Dry Runway, Standard Temperature, Sea-Level Pressure Altitude)	107 KIAS (All Weight Conditions)
VR – Rotation Speed (Dry Runway, Standard Temperature)	108 KIAS (Sea Level, 13,200 lb) 118 KIAS (Sea Level, 20,200 lb) 108 KIAS (5,000 ft, 13,200 lb) 119 KIAS (5,000 ft, 20,200 lb)
V2 – Minimum Climb Speed (Dry Runway, Standard Temperature)	120 KIAS (Sea Level, 13,200 lb) 129 KIAS (Sea Level, 20,200 lb) 120 KIAS (5,000 ft, 13,200 lb) 130 KIAS (5,000 ft, 20,200 lb)
VREF – Landing Approach Speed (flaps 40, gear down)	102 KIAS (Sea Level, 13,200 lb) 123 KIAS (Sea Level, 20,200 lb) 103 KIAS (5,000 ft, 13,200 lb) 123 KIAS (5,000 ft, 20,200 lb)
Best Glide Speed	160 KIAS (Gear and Flaps Up, Both Engines Inoperative)

Bombardier Learjet 45 Flying Tips

- **Required Runway Length:** 4,700 feet for takeoff with flaps at 8 degrees. 3,200 feet for landing with flaps at 20 degrees. These figures assume a weight of 20,000 lb, a sea-level altitude, no headwind, and a temperature of 15 degrees Celsius.
- **Taxiing:** Apply the necessary power to get rolling (F3 as necessary), and then reduce thrust level to *idle* (F2). Use rudder for directional control.
- **Takeoff:** Set flaps to *8* or *20,* as desired (F7 as necessary). Align the plane with the runway centerline and advance throttle to 40 percent (F3 as necessary). Once engines stabilize to symmetrical thrust, advance throttle to 93–96 percent (F3 as necessary). Lift off at approximately 143 KIAS and raise the nose to 10 degrees above the horizon. Retract landing gear (G) once aircraft is showing a positive rate of climb. Retract flaps (F6 as necessary) at 176 KIAS.
- **Ascent:** Maintain an ascent speed of 250 KIAS (approximately 1,800–2,000 feet per minute) until reaching .7 Mach. The changeover from indicated airspeed to Mach number typically occurs as you climb to altitudes in the high 20,000s or low 30,000s. Normal cruise speed is .77 Mach. Set power around 90 percent (F2 or F3 as necessary). If the console is showing airspeed, it should settle at around 280 KIAS.

➢ **Descent:** Reduce power to *idle* (F2 as necessary). Adjust power as needed (F2 or F3) to maintain speed and rate of descent. Once below 10,000 ft, don't exceed 250 KIAS. Your target speed as you enter your approach is 200 KIAS. Extend 8 degrees of flaps (F6 or F7 as necessary) and let the airplane stabilize at 180 KIAS. During turn toward runway, extend 20 degrees of flaps (F6 or F7 as necessary).

Tip *In* cruise, *the Learjet 45 gives its best maximum-weight speed performance at 33,000 feet, where it maneuvers at 444 KIAS and burns approximately 1,715 lb of fuel per hour.*

➢ **Landing:** Maintain final approach speed of 140 KIAS. Lower landing gear (G). Set 40 degrees of flaps (F6 or F7 as necessary) upon glide-slope intercept. Look for a descent rate of about 700 feet per minute. Landing speed should be approximately 120–125 KIAS.

➢ **Touchdown:** At about 50 feet above the runway, reduce thrust to *idle* (F2 as necessary). Hold pitch attitude and don't try to raise or lower the nose. Deploy *spoilers* on touchdown (/), add reverse thrust (F2 until reverse) and apply brakes (Period key). When airspeed drops below 60 knots, come out of reverse thrust and return to *idle* (F3 until idle). Lower the spoilers, exit the runway, and taxi to parking.

Mooney Bravo

Table 2.32: Mooney Bravo Specifications

ITEM	U.S.	METRIC
Maximum Speed	220 kts (253 mph)	407 kph
Cruise Speed	195 kts (224 mph)	361 kph
Maximum Range	1,050 nm	1,945 km
Service Ceiling	25,000 ft	7,620 m
Fuel Capacity	89 gal	337 L
Maximum Gross Weight	3,368 lb	1,528 kg
Length	26.75 ft	8.15 m
Wingspan	36 ft	11 m
Height	8.33 ft	2.5 m
Useful Load	1,100 lb	500 kg
Engine	Textron Lycoming TIO-540-AF1B 270 hp	
Propeller	McCauley Three-Bladed Constant Speed	
Seating	Up to Four	
Total Flight Simulator Aircraft Weight with Full Fuel	3,326 lb	

Table 2.33: Mooney Bravo V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VA – Maneuvering Speed	127 KIAS (3,368 lb) 123 KIAS (3,200 lb) 117 KIAS (2,900 lb)
VFE – Maximum Flaps Extended Speed	110 KIAS (Flaps Full)
VLE – Maximum Landing Gear Extension Speed	165 KIAS
VLO – Maximum Gear Operating Speed	140 KIAS (Extension) 106 KIAS (Extraction)
VNO – Maximum Structural Cruising Speed	174 KIAS
VNE – Never Exceed Speed	195 KIAS
VS – Stalling Speed (Maximum Weight, Flaps Up)	66 KIAS

Tip *Those curious about the latest in the Mooney Bravo series should fly over to Mooney's official homepage for the Bravo series at http://www.mooney.com/Pages/bravodx.html.*

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VSO – Stalling Speed in the Landing Configuration	59 KIAS
VX – Best Angle-of-Climb Speed	85 KIAS
VY – Best Rate-of-Climb Speed	105 KIAS
Best Glide Speed	93.5 KIAS (3,368 lb) 89 KIAS (3,200 lb) 84.5 KIAS (2,900 lb) 80 KIAS (2,600 lb)

Mooney Bravo Flying Tips

- **Required Runway Length:** 2,000 feet for takeoff with flaps at 10 degrees. 2,500 feet for landing with flaps at *full.* These figures assume a weight of 3,200 lb, a sea-level altitude, no headwind, a temperature of 15 degrees Celsius, and a hard runway surface.
- **Taxiing:** Power should be set at about 1,000 rpm (F2 or F3 as necessary). Propeller (Ctrl + F2 or Ctrl + F3 as necessary) and mixture (Ctrl + Shift + F3 until fully in) should be set to *full forward.* Use rudder for directional control.
- **Takeoff:** Set flaps to 10 degrees (F6 or F7 as necessary). Cowl flaps should be open for the takeoff and the climb (click *cowl flaps* switch). Align the Bravo on the runway and set the throttle to full power (F3 as necessary). Lift off at about 60 KIAS and raise the nose to 10 degrees above the horizon. Climb out at 85 KIAS. Retract landing gear (G) upon positive climb.
- **Ascent:** Raise flaps (F6 until up). Set propeller to approximately 2,400 rpm (Ctrl + F2 or Ctrl + F3 as necessary). Cowl flaps remain open. (Closed them for cruise and descent.) Climb speed should be around 120 KIAS.
- **Descent:** Typical descent (rate of 500–750 feet per minute) is done at about 150 KIAS. Set propeller to approximately 2,000 rpm (Ctrl + F2 or Ctrl + F3 as necessary). Initial approach target speed is around 110 KIAS. Below 110 KIAS, extend flaps (F7 as necessary).
- **Landing:** Extend landing gear (G) when speed drops to 140 KIAS. Final approach with full flaps should be flown at approximately 75 KIAS. Propeller and mixture controls should be *full forward.*
- **Touchdown:** Reduce power to *idle* (F2 to idle), apply brakes (Period key), retract wing flaps (F6), and exit the runway.

Tip Flight Sim *enthusiast Burton Maugans offered this tip for the Mooney Bravo: When looking for a small plane in which to do some sightseeing, most people seem to choose the default Cessna—probably because that's the plane they trained in. Try the Mooney Bravo instead. It's a faster, more maneuverable small plane that is excellent for flying around the countryside, and is a decent little acrobat, too. Takeoffs and landings are just as easy in the Bravo as they are in the Cessna.*

Robinson R22 Beta II

Table 2.34: Robinson R22 Beta II Specifications

ITEM	U.S.	METRIC
Maximum Speed	102 kts	189 kph
Cruise Speed	96 kts	178 kph
Maximum Range	200 nm	371 km
Service Ceiling	14,000 ft	4,267 m
Hovering Ceiling	9,450 ft	2,880 m
Fuel Capacity	29.7 gal	112 L
Empty Weight	830 lb	376 kg
Maximum Gross Weight	1,370 lb	621 kg
Length	28.75 ft	8.75 m

Tip *If you're interested in learning more about the Robinson R22 Beta II and other Robinson helicopters, visit Robinson's official homepage for the R22 at http://www.robinsonheli.com/BetaII.htm. The site includes fact sheets, performance details, specifications, and interior and exterior features.*

ITEM	U.S.	METRIC
Rotor Span	25.2 ft	7.68 m
Height	9 ft	2.74 m
Engine	Lycoming O-360, 150 Brake Horsepower	
Seating	Two	
Total Flight Simulator Aircraft Weight with Full Fuel	1,370 lb	

Table 2.35: Robinson R22 Beta II V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
VNE – Never Exceed Speed	102 KIAS
Maximum Autorotation Sped	65 KIAS
Maximum Rate-of-Climb Speed	53 KIAS

Robinson R22 Beta II Flying Tips

- **Required Runway Length:** It's simply the length of the R22's landing skids! The Robinson R22 can land on buildings, in small open clearings—virtually anywhere, except water.
- **Hover-Taxiing:** Used when you need to move the helicopter a short distance, akin to taxiing in an airplane. Given typical weather conditions and operating weights, apply 70–75 percent torque to hover-taxi.
- **Takeoff:** If possible, plan to take off directly into the wind to minimize sideways drift and increase the helicopter's performance. Ensure that cyclic pressure is *neutral* and set collective to *full down* (F2 until down). Slowly raise the collective (F3 as necessary) to 50 percent torque and continue slowly up to 60 percent, where you should notice the helicopter lifting off of the ground. If the helicopter drifts right, use left cyclic pressure (left on the controller) to hold position. Continue to smoothly increase the collective to continue the liftoff. Apply forward pressure on the controller to lower the nose and begin moving forward along the departure path.

Tip *In the Learning Center, check out the "Flight Notes" for the JetRanger and Robinson R22 to learn about autorotation, which is equivalent to a power-off glide in an airplane. Autorotation is important when simulating an engine failure in a helicopter.*

- **Ascent:** Can climb at a maximum rate of approximately 1,300 feet per minute (at sea level under standard weather conditions). Best rate of climb 53 knots, though 60–65 knots is a good climb speed because it's also the speed for autorotation if the engine fails. Adjust collective (F3 as necessary) to 10 percent over that required to maintain a hover: typically 80–85 percent for a normal climb. Expect torque to drop 3 percent per thousand feet of altitude gained.

- **Descent:** As in the ascent, decrease the collective (F2 as necessary) gradually to maintain a controlled descent. Expect torque to increase 3 percent per thousand feet of altitude lost. The helicopter's nose will drop as you decrease torque, so pull back gently on the control as needed.
- **Landing:** Keep an eye on your landing area at all times. If you're landing in the bush, ensure that the landing area is wide enough to accommodate the rotor blades. A descent angle of 10–12 degrees provides good obstacle clearance and helps keep the landing area in sight. Adjust the collective (F2 or F3 as necessary) to increase or decrease rate of descent.
- **Touchdown:** Plan a three-foot hover over the landing spot for a soft landing. Increase collective (F3 as necessary) to slow descent as you near the landing spot. If you begin to rise, carefully decrease collective (F2 as necessary). Apply gentle control pressure if needed. Once hovering slightly above the landing spot, lower the collective slowly to settle onto the landing spot. When the helicopter is *completely* down, lower collective all the way (F1).

Schweizer 2-32 Sailplane

Tip *The 2-32's ancestor, the Schweizer SGS 2.8 sailplane, established an American two-place distance record of 219 miles in 1940. On June 20th, 2002, Mike Barber set a new, unofficial, world record at 437.8 miles total distance on a hang glider. You can read more and see pictures at http://www.flytec.com/news.html.*

Table 2.36: Schweizer 2-32 Sailplane Specifications

ITEM	U.S.	METRIC
Maximum Speed	137 kts (158 mph)	254 kph
Empty Weight	850 lb	386 kg
Length	26.75 ft	8.78 m
Wingspan	57 ft	18.7 m
Wing Area	180 sq. ft	19.37 sq. m
Maximum L/D	~57 kts (~66 mph)	~106 kph
Maximum Sink	~47 kts (~54 mph)	~87 kph
Useful Load	430 lb	195 kg
Engine	None	
Glide Ratio	36 to 1	
Aspect Ratio	18.05	
Seating	Up to Two	

Table 2.37: Schweizer 2-32 Sailplane V-Speeds

V-SPEED	INDICATED AIRSPEED IN KNOTS (KIAS)
Maximum Glide Speed	158 MPH IAS (Dive Brakes Open) 150 MPH IAS (Dive Brakes Closed)
Minimum Sink Speed	54 MPH IAS
VS – Stall Speed	47 MPH IAS
Spiraling in Thermals	58 MPH IAS (30-Degree Bank) 60 MPH IAS (45-Degree Bank)
Best Glide Speed	64 MPH IAS

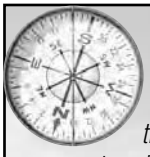
Schweizer 2-32 Sailplane Flying Tips

- **Required Runway Length:** 1,000 feet for landing. The length required for landing assumes maximum gross weight, a sea-level altitude, no headwind, a temperature of 15 degrees Celsius, and a hard runway surface. For takeoff, use *A Century of Flight*'s *slewing* (positioning without flight) feature. To learn more, read the "Positioning Your Aircraft" section of the Learning Center or read the instructions under "Takeoff," later in this section.
- **Taxiing:** The Schweizer 2-32 Sailplane has no engine, so there is no startup or taxiing.

- **Takeoff:** Use the slew feature to raise the aircraft to altitude. Press the Y key to activate slewing, and F4 to gain altitude. At an altitude of 3,000–4,000 feet, deactivate slewing by pressing the Y key again. Use spoilers (/) to control speed while recovering to soaring flight. Lower the spoilers once you level off.

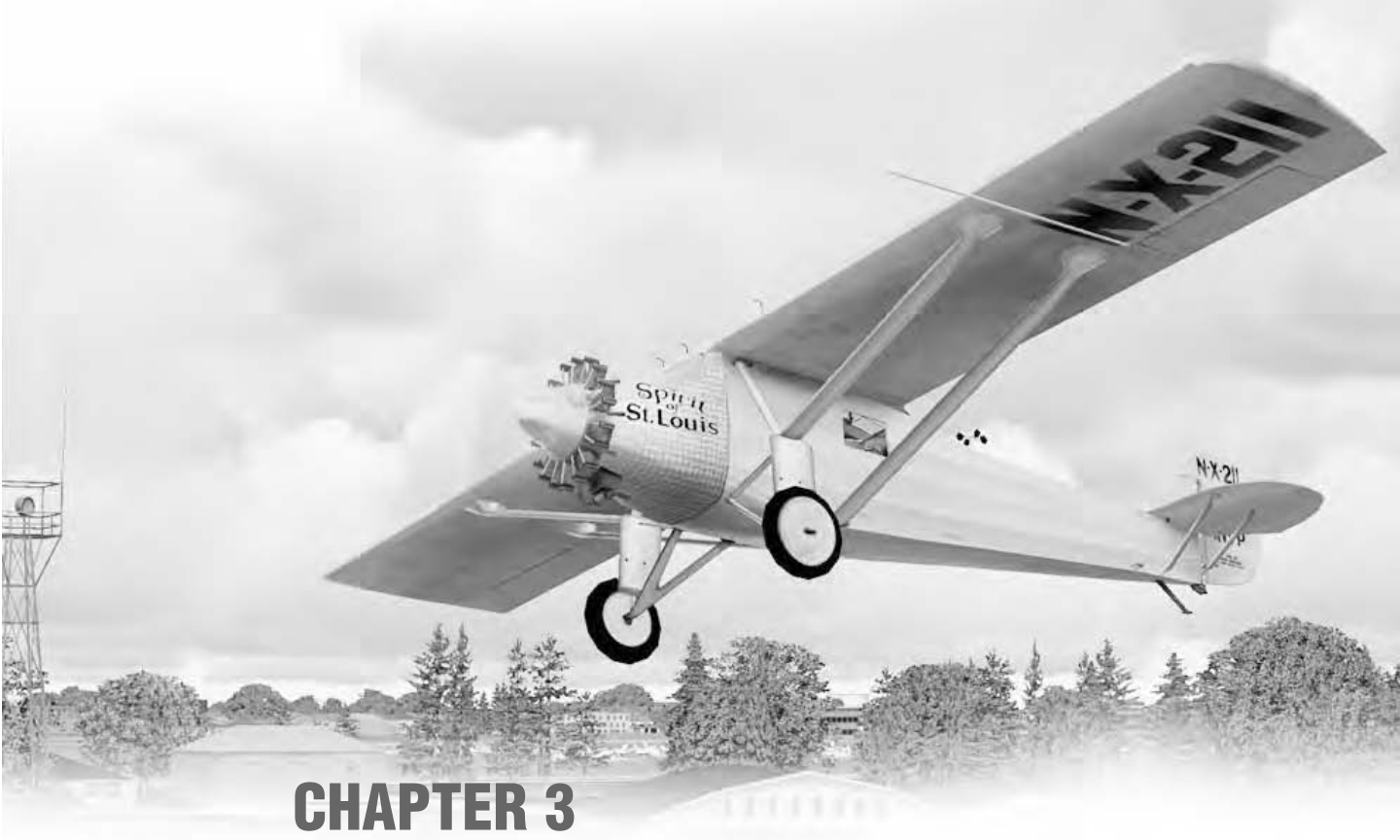
Tip *Seeking optimum soaring areas? You'll find ridge lift in scenic areas near Munich, San Francisco, and Seattle, where air is forced upward near mountains. You'll also find thermals—warm, rising air—on the coast near San Francisco, and near Lake Chelan, across the Cascade Mountains from Seattle. Choose from several soaring flights designed for the sailplane in the "Select Flight" dialog box.*

- **Ascent:** The key to maintaining altitude in the sailplane is finding air that is rising as fast or faster than the sailplane is descending. When soaring in rising air and going for distance, fly at approximately 66 mph. If you're trying to stay in lift and just increase altitude, fly at minimum sink, approximately 54 mph.
- **Descent:** With no engine, you'll have only one shot at landing the sailplane, unless you use the slew feature to gain more altitude artificially. Using a GPS (Shift + 2), you can gauge how far you are from the airport. Use the sailplane's glide ratio to gauge descent (one mile of altitude equals 36 miles of distance in ideal conditions). You can use spoilers (/) to increase descent rate. Fly an approach at 65–70 mph.



Tip *The glide ratio statistic shown in the sailplane's specifications table means that for every one mile of altitude, the sailplane can travel 36 miles of distance. This is in ideal conditions, however. Real-world soaring pilots use a safety margin of one-half or two-thirds of the sailplane's actual performance. With that in mind, use* 20-to-1 *as a good measure for safety. So for every one mile of altitude, the sailplane can travel 20 miles horizontally.*

- **Landing:** When crossing the runway threshold, raise the nose slightly to slow to around 50 mph. Deploy spoilers (/) before touchdown.
- **Touchdown:** Do not flare; hold a level attitude close to the ground and let the sailplane settle to a smooth, level touchdown. Once on the ground, use the rudder for directional control.



CHAPTER 3
Historical Aircraft Reference

Confucius once said, "Study the past if you would define the future." The personal and commercial aircraft used today, and the designs that will be used in the future, are still closely based on the pioneering advances in aircraft design and technology that first leaped into the world's consciousness almost exactly a century ago, when—on December 17th, 1903—Orville and Wilbur Wright's Flyer made the first powered, controlled flight.

Flight Simulator 2004: A Century of Flight ***includes for the first time historical aircraft—nine planes, from the 1903 Wright Flyer and Lindbergh's*** **Spirit of St. Louis** ***to Amelia Earhart's Model 5B Vega. You can fly them all, in custom or historical flights. For a fantastic, and quite elaborate, source of information on each of these significant aircraft, click on the "Century of Flight" section in the*** **FS 2004** ***Main Menu to read Lane Wallace's eloquent articles on the spirit of these historical planes. This chapter provides specifications, v-speeds, and flying tips for all historical aircraft available in*** **Flight Simulator 2004: A Century of Flight.**

Curtiss JN-4D "Jenny"

Table 3.1: Curtiss JN-4D "Jenny" Specifications

ITEM	U.S.	METRIC
Maximum Speed	65 kts (75 mph)	121 kph
Maximum Range	160 mi	257 km
Service Ceiling	11,000 ft	3,353 m
Fuel Capacity	21 gal	79 L
Maximum Takeoff Weight	1,920 lb	871 kg
Length	27 ft, 4 in	8.3 m
Wingspan	43 ft, 7 in	13.35 m
Height	9 ft, 10-5/8 in	4.7 m
Useful Load	460 lb	208 kg

Tip *Learn about a three-year "Jenny" restoration project, which went airborne in June 2001, at the following Web site: http://www.benncomm.com/ancient/rhinebck/jenny/jenny1.htm. You can find additional information at the U.S. Centennial of Flight home page for the Curtiss JN-4 series, at http://www.centennialofflight.gov/essay/Aerospace/Jenny/Aero3.htm.*

ITEM	U.S.	METRIC
Engine	90 hp Curtiss OX-5	
Seating	Two	
Total Flight Simulator Aircraft Weight with Full Fuel	1,920 lb	

Table 3.2: Curtiss JN-4D "Jenny" V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
VS – Stalling Speed	45 mph
VY – Best Rate of Climb Speed (Sea Level)	55 mph

Curtiss JN-4D "Jenny" Flying Tips

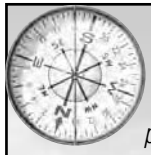
- **Required Runway Length:** You can take off and land in the Curtiss "Jenny" on any runway in *Flight Simulator 2004*.
- **Taxiing:** Like many historical planes, the Curtiss "Jenny" is a taildragger. Consult the "Flying Taildraggers" section of the Learning Center for complete instruction and tips on taxiing, taking off, and landing in a taildragger. The basics include using "S-turns" when taxiing. Do this by steering the nose left and right (using your rudder control) as you taxi, to see ahead of you through the side windows. You can also try rolling straight, while looking out the left or right window and maintaining your position relative to the taxiway or runway line.

Tip *Here are some essential keyboard shortcuts for taxiing and flying these historical planes.* Shift+Enter *moves your viewpoint up, essentially raising your seat. This provides a better view over the plane's nose, which is helpful when taxiing. Use the Backspace key to reset the view. You can toggle through cockpit panel options with the W key. (Press the key once to remove the panel and replace it with necessary gauges; press the key again to remove all gauges; and press the key a final time to restore the original panel. You also can switch to* external *or* top-down *views using the S key. But for a real challenge, stick with the default cockpit view and fly the plane as the original pilot did!*

- **Takeoff:** Align your plane with the runway's centerline and apply power to the Jenny smoothly (F3 as necessary). As the plane moves down the runway, apply forward pressure on the control until the tail rises (the nose will dip). The Jenny has no airspeed indicator, so even though the tail typically comes up at about 25 mph, it will be impossible to coordinate your speed with the tail's rising. When the nose dips and the tail lifts, ease off forward pressure on the control, or the Jenny could dip over onto the propeller. Now with the tail up, smoothly apply back-pressure on the controller and the Jenny will take off. It's possible to lift off the runway in less than 300 feet.

Tip *For definitions of the terms used in the specification and v-speed charts for each of the aircraft in this chapter, read the "Statistics Explained" section at the beginning of Chapter 2. For complete checklists for all of these historical aircraft, flip to Appendix B.*

- **Ascent:** Maintain a low-angle ascent to keep your speed high and out of stall-speed range (45 mph—although, as I said, the Jenny has no speedometer). If your ascent angle is too high, your speed will drop rapidly. Keep the throttle at *full* (F4). Regardless of ascent angle, don't *bank* while climbing, as the maneuver's affect on speed can put the Jenny into a stall. Keep the fuel gauge (at the top of the panel) above the horizon to ensure an ascent.
- **Descent:** The Jenny can be slowed quickly. Maintain cruise speed for your descent, and reduce power as necessary (F2). Slow near the airport, to set up the approach and landing.
- **Landing:** The "Flying Taildraggers" section of the Learning Center offers detailed coverage of taildragger landing techniques. Flight notes for the Jenny favor a *wheel landing* over a three-point landing. Try to touch down on the aircraft's main gear at a level or nearly level attitude while the tail is still in the air. As the Jenny slows, her tail drops and the tail wheel touches the ground.



Tip *With no airspeed indicator, it's useful to listen to wind speed when flying the "Jenny." Increase your* Environment *sound level (see Chapter 1) to better detect changes in wind volume. The louder the wind, the faster you're traveling. And in the Jenny,* faster *generally means* descent*—so be prepared to adjust pitch accordingly!*

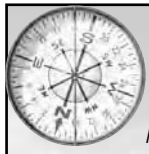
- **Touchdown:** Try to land gently on the main gear, with minimal vertical drop. Reduce power to *idle* (F2 as necessary) at touchdown. Apply *gentle* forward pressure on the control to help keep the Jenny from bouncing back into the air. Once the tail drops, apply full back pressure on the controls and roll to a stop.

deHavilland DH-88 Comet

Table 3.3: deHavilland DH-88 Comet Specifications

ITEM	U.S.	METRIC
Maximum Speed	206 kts (237 mph)	382 kph
Cruise Speed	163 kts (188 mph)	302 kph
Maximum Range	958 mi	1,542 km
Service Ceiling	22,800 ft	6,950 m
Fuel Capacity	258 gal	1,032 L
Maximum Takeoff Weight	5,250 lb	2,381 kg
Length	29 ft	9 m
Wingspan	44 ft	13.4 m

(continued on next page)



Tip *You can read more about the deHavilland DH-88 Comet and the restoration projects mentioned in the DH-88's Learning Center description at http://www.shuttleworth.org/collection/comet.htm. The site provides coverage and links to pictures of the Grosvenor House flight on October 28, 2002. Seek more information about the Black Magic restoration project at http://www.blackmagic.abelgratis.com/.*

Table 3.3: deHavilland DH-88 Comet Specifications ***(continued from previous page)***

ITEM	U.S.	METRIC
Height	10 ft	3 m
Useful Load	2,320 lb	1,052 kg
Engine	Two 230 hp deHavilland Gypsy 6R	
Propeller	Ratier Pneumatic Airscrews	
Seating	Two	
Total Flight Simulator Aircraft Weight with Full Fuel	5,250 lb	

Table 3.4: deHavilland DH-88 Comet V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
VNO – Maximum Structural Cruising Speed	174 mph
VNE – Never Exceed Speed	300 mph
VLE – Maximum Gear Extension Speed	150 mph
VS – Stalling Speed	74 mph
VY – Best Rate of Climb Speed (Sea Level)	140 mph
VFE – Maximum Flaps Extended Speed	120 mph (Flaps Full)

deHavilland DH-88 Comet Flying Tips

- **Required Runway Length:** 2,500 feet under ISA conditions.
- **Taxiing:** The DH-88's long nose obstructs the view of even the tallest pilot. Make S-turns (using the rudder for directional control from left to right) while taxiing, to see along the taxiway and runway. Or, if needed, remove the cockpit panel, by pressing the W key once.

Tip *The Comet is simply, for the lack of a better adjective, a fun aircraft, with its sports-car-like engine sound and loose maneuverability. The first leg of the deHavilland's* historical flight *("MacRobertson Race") begins just before dawn in London. It's a beautiful takeoff into a dark sky illuminated by lightning flashes. The flight is long but has simple navigation changes (outlined in the leg's briefing). This offers an extended opportunity to enjoy and learn the deHavilland's flight characteristics.*

- **Takeoff:** Align the Comet with the runway centerline. Advancing both throttles to *full* makes the DH-88 swing nose-right (if you are at full *Realism*—see Chapter 1), so use your rudder to maintain control. Lock the tail skid (Shift + G) to assist in directional control. You can operate the throttles separately by pressing E + 1 to select the left engine (then F3 to advance its throttle), and E + 2 to select the right engine (then F3 to advance its throttle). Or press Shift + 4 to display the throttles, and use the mouse to drag them into position. When the tail rises, advance both throttles to full power. Apply forward pressure on the control at 65 mph. At 80 mph, ease the stick back and allow the Comet to lift off.
- **Ascent:** Maintain a climb speed between 140 and 150 mph at 2,000 rpm (use F2 and F3 as necessary). Mixture control (Ctrl + Shift + F2 or Ctrl + Shift + F3 as necessary) should not be used below 7,000 feet. Consult the deHavilland DH-88's flight notes in the Learning Center for further information on cruising in the Comet, with highlights on fuel levels and aircraft weight. At cruise altitude of 10,000 feet, your airspeed at full throttle should be approximately 188 mph.
- **Descent:** A normal Comet descent is done at no less than 20" of manifold pressure and 2,050 rpm. If cruising at 10,000 feet, begin your descent 30 nm from your destination (plus two miles for every 10 knots of tailwind). Reduce airspeed to 150 mph, at which point you can lower the landing gear (G). When you drop below 7,000 feet, return mixture to *rich* (Ctrl + Shift + F4). Slow to below 120 mph before lowering the flaps (F7 as necessary). Lock the tail skid (Shift + G) if necessary.

Tip *The DH-88's ideal cruise altitude is 10,000 feet. To ensure maximum range for the Comet,* lean *the mixture (reduce fuel supply to the carburetor) upon reaching cruise altitude. Only lean the mixture above 7,000 feet. If you have* automixture *toggled on in the* Realism *settings, this will be handled for you.*

- **Landing:** Plan to land the Comet at 85–95 mph, with full flaps (F7). Make a wheel landing (consult the "Flying Taildraggers" section of the Learning Center) and touch down with the tail slightly low.
- **Touchdown:** Once you're on the runway, let the tail settle to the ground, apply the brakes as needed (Period key), unlock the tail skid (Shift + G), and use your rudders to control your taxi off of the runway.

Douglas DC-3

Table 3.5: Douglas DC-3 Specifications

ITEM	U.S.	METRIC
Cruise Speed	161 kts (185 mph)	298 kph
Maximum Range	1,845 nm (2,125 mi)	3,420 km
Service Ceiling	23,200 ft	7,071 m
Fuel Capacity	604 gal	2,286 L
Maximum Takeoff Weight	26,200 lb	11,884 kg
Length	65.5 ft	20 m
Wingspan	95 ft	29 m

Tip *If you're interested in reading more about the Douglas DC-3, check out Boeing's McDonnell Douglas History section (highlighting the DC-3 specifically) at http://www.boeing.com/history/mdc/dc-3.htm. You'll also find extensive biography and background information on Donald Douglas. Additional Douglas DC-3 pictures and background can be found at the U.S. Centennial of Flight home page for the DC-3 at http://www.centennialofflight.gov/essay/Aerospace/DC-3/Aero29.htm.*

ITEM	U.S.	METRIC
Height	17 ft	5.18 m
Useful Load	10,055 lb	4,560 kg
Engine	Two Pratt & Whitney R-1830s	
Seating	21–28	
Total Flight Simulator Aircraft Weight with Full Fuel	26,200 lb	

Table 3.6: Douglas DC-3 V-Speeds

V-SPEED	INDICATED AIRSPEED IN MILES PER HOUR (MPH) AND KNOTS (KIAS)
VS – Stalling Speed	77 mph
VSO – Stalling Speed in Landing Configuration	71 mph
Turbulent Air Penetration Speed	105 mph
VMC – Minimum Controllable Speed	89 mph
VLE – Maximum Landing Gear Extension Speed	166 mph
VY – Best Rate of Climb Speed (Sea Level)	120 mph
VYSE – Best Rate of Climb Speed (Single-Engine)	110 mph
VFE – Maximum Flaps Extended Speed	154 KIAS (Flaps 1/4) 114 KIAS (Flaps 1/2) 112 KIAS (Flaps 3/4) 112 KIAS (Flaps full)
V1 – Takeoff Decision Speed (Dry Runway, Standard Temperature, Sea Level Pressure Altitude)	97 mph (26,200 lb)
VR – Rotation Speed (Dry Runway, Standard Temperature, Sea Level Pressure Altitude)	97 mph (26,200 lb)
V2 – Minimum Climb Speed (Dry Runway, Standard Temperature, Sea Level Pressure Altitude)	97 mph (26,200 lb)

Douglas DC-3 Flying Tips

- **Required Runway Length:** 1,600 feet for takeoff with no flaps; 2,500 feet for landing with approach flaps extended. These figures assume a weight of 25,000 lb, a sea level altitude, no headwind, a temperature of 15 degrees Celsius, and a hard surface runway.
- **Taxiing:** Raise your eye level (Shift + Enter) or toggle the cockpit panel (W) if you have trouble seeing over the DC-3's nose. Adjust power between 800 and 1,000 rpm (F2 or F3 as necessary) for normal taxi speed. Lock or unlock tail wheel (Shift + G) as needed, for better directional control. Use rudders for directional control along the taxiway and runway.

- **Takeoff:** Align the DC-3 with the runway centerline, lock the tail wheel (Shift + G) and adjust propellers to *full forward* (Ctrl + F3 until fully forward). At sea level and standard temperature, takeoff power is 2,750 rpm (Ctrl + F2 or Ctrl + F3 as necessary) and 48" Hg (mercury) manifold pressure (F2 or F3 as necessary). When you reach 58 mph (50 knots), the tail will rise. Apply forward pressure on the control. Upon reaching approximately 97 mph (84 knots), lift off by gently pulling back on the controls. Hold speed until you achieve a positive rate of climb, at which point you can retract the landing gear (G).
- **Ascent:** Optimum climb speed is 120 mph (105 knots). When you reach it, reduce power to 35" manifold pressure (F2 as necessary) and reduce propellers to 2,350 rpm (Ctrl + F2 as necessary). With any runway obstacles, such as trees or structures, cleared, allow your speed to increase to 132–138 mph (115–120 knots), up to cruising altitude. Adjust your throttle (F2 and F3 as necessary) and mixture (Ctrl + Shift + F2 and Ctrl + Shift + F3 as necessary) to maintain the best rate of climb. Typical cruise power setting (at 10,000 feet) is 28" manifold pressure and 2,050 rpm. Expect an airspeed of around 140 knots and a fuel burn of 92 gallons an hour.
- **Descent:** Adjust *thrust* during descent to maintain 135 knots (F2 or F3 as necessary). Propeller levers should remain at 2,050 rpm (Ctrl + F2 or Ctrl + F3 as necessary). At a typical cruise altitude of 10,000 feet, begin your descent when you're about 30 nm from your destination, at a rate of 500 feet a minute. (Add two nm for every 10 knots of tailwind.)

Tip *Consult the Douglas DC-3's flight notes in the Learning Center for tips on using the DC-3's autopilot feature, including a complete legend for its gauges, and a written tutorial on using the autopilot in your DC-3 flights.*

- **Landing:** In your approach phase, reduce power to 20" of manifold pressure at a speed of 105 knots (F2 or F3 as necessary). Set flaps to *one-fourth* (F6 or F7 as necessary) and extend the landing gear (G). Lower the flaps to *three-fourths* (F6 or F7 as necessary), and finally, on the base leg of your approach, to *full* (F7 until full). Reduce speed to 104 mph (90 knots).
- **Touchdown:** Power should be at 15" Hg and 2,050 rpm. Raise the nose slightly, to *flare* upon touchdown. Bring power to *idle* (F2 until idle), and apply back-pressure on the controls. When the DC-3's wheels contact the ground, adjust your propeller levers to *full forward* (Ctrl + F3 until fully forward). Apply forward pressure on the controls to let the tail down gently. Smoothly use brakes (Period key), and slow to taxi speed. Use rudder for directional control off the runway.

Ford 4-AT-E Tri-Motor

Table 3.7: Ford 4-AT-E Tri-Motor Specifications

ITEM	U.S.	METRIC
Maximum Speed	113 kts (130 mph)	209 kph
Cruise Speed	96 kts (110 mph)	177 kph
Maximum Range	670 mi	1,078 km
Service Ceiling	14,500 ft	4,420 m
Fuel Capacity	231 gal	874 L
Maximum Takeoff Weight	10,130 lb	4,595 kg
Length	49 ft, 10 in	15 m

(continued on next page)

Tip *Browse the following Web sites for even more info and data on the Ford 4-AT-E Tri-Motor. Link to the Aerofiles Web site at http://www.aerofiles.com/ford-locator.html for locations of authentic Ford AT series Tri-Motors across the country. Also, the Airventure Museum Tri-Motor home page at http://www.airventuremuseum.org/collection/aircraft/Ford Tri-Motor.asp offers more background info on the Ford 4-AT-E Tri-Motor, including additional specs.*

Table 3.7: Ford 4-AT-E Tri-Motor Specifications ***(continued from previous page)***

ITEM	U.S.	METRIC
Wingspan	74 ft	22.55 m
Height	12 ft, 8 in	3.89 m
Useful Load	3,530 lb	1,601 kg
Engine	Three Wright Whirlwind J-6; 300 hp Each	
Propeller	Two-Bladed, Metal	
Seating	Up to 12	
Total Flight Simulator Aircraft Weight with Full Fuel	10,130 lb	

Table 3.8: Ford 4-AT-E Tri-Motor V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
VA – Maneuvering Speed	107 mph
VS – Stalling Speed	58 mph
VNE – Never Exceed Speed	145 mph
VY – Best Rate of Climb Speed (Sea Level)	72 mph
VYSE – Best Rate of Climb Speed (Single-Engine)	75 mph
VR – Rotation Speed (Dry Runway, Standard Temperature, Sea Level Pressure Altitude)	65 mph (10,130 lb)

Ford 4-AT-E Tri-Motor Flying Tips

- **Required Runway Length:** 2,000 feet under ISA conditions. The Ford Tri-Motor can get in and out of runways shorter than 2,000 feet, but this length is recommended for safe operation.
- **Taxiing:** Use Shift + Enter to raise your eye level if you have trouble seeing over the nose. Propeller (Ctrl + F3 until fully forward) and mixture (Ctrl + Shift + F3 until fully forward) should be *full forward* on all engines when taxiing. Use the rudder for directional control, and use your brakes (Period key) only if necessary for turning.
- **Takeoff:** Align the Tri-Motor with the runway's centerline and advance the throttles on the two outboard engines first (E + 1 then F3; E + 3 then F3) to 1,000 rpm before opening center engine throttle (E + 2 then F3) to 1,000 rpm. Once done, advance all engines to full power for takeoff. Liftoff at approximately 60 mph.

- **Ascent:** Climb at 80 mph (approximately 2,000 rpm) and maintain that speed until you reach cruise altitude, typically 5,000–7,500 feet. Cruise power is generally 1,750–1,900 rpm (F2 or F3 as necessary) and 95–110 mph. Lean mixture (Ctrl + Shift + F2 and Ctrl + Shift + F3 as necessary) at cruise altitude.
- **Descent:** Adjust throttle to maintain a 90 mph airspeed and descent rate of 500 feet per minute. (At a typical cruise altitude of 7,500, begin descent around 22.5 nm from your destination.) Initial approach airspeed should be 75–80 mph with *rich* mixture (Ctrl + Shift + F4).

Tip *Read more on the challenge of navigating in historical planes—without using the hand-held GPS—in Chapter 6, "In-Flight Navigation." The chapter offers navigation insights for each historical plane and also features a VFR (Visual Flight Rules) challenge specifically for the Ford 4-AT-E Tri-Motor.*

- **Landing:** Reduce final approach speed to 60–65 mph. A *wheel* landing offers more control than a *three-point* landing. (Read about wheel landings in the "Flying Taildraggers" section of the Learning Center.)
- **Touchdown:** At touchdown, reduce power to all engines to *idle* (F2 until idle). Apply brakes (Period key), and use rudder for directional control off of runway.

Model 5B and 5C Vega

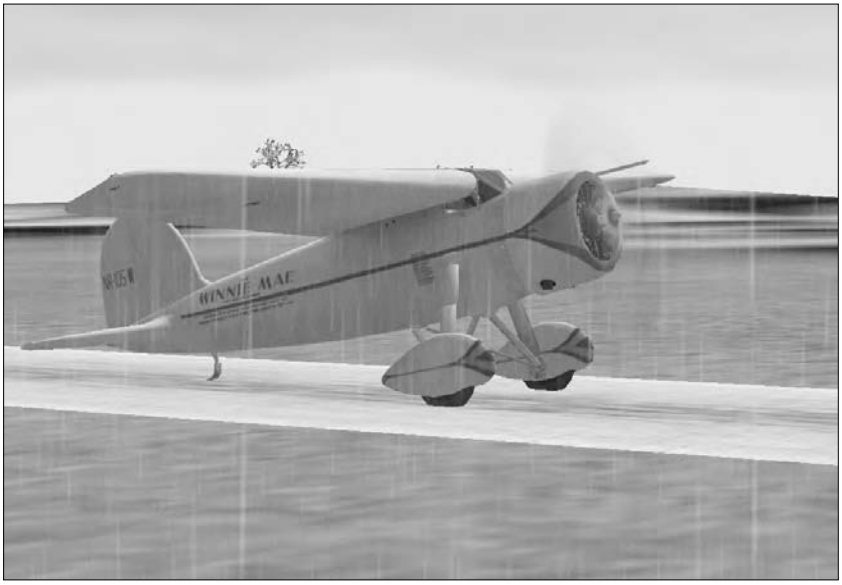
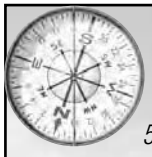


Table 3.9: Model 5B and 5C Vega Specifications

ITEM	U.S.	METRIC
Maximum Speed	210 mph	338 kph
Cruise Speed	160 mph	258 kph
Maximum Range	725 mi	1,167 km
Service Ceiling	22,000 ft	6,706 m
Fuel Capacity	650 gal	2,460 L
Maximum Takeoff Weight	6,630 lb	3,007 kg
Length	27 ft, 6 in	12.49 m
Wingspan	41 ft	8.38 m
Height	8 ft, 2 in	2.49 m
Useful Load	4,065 lb	1,844 kg
Engine	Pratt & Whitney Wasp C, 500 hp	
Propeller	Two-bladed, Fixed Pitch	
Seating	Six	
Total Flight Simulator Aircraft Weight with Full Fuel	6,630 lb	

Table 3.10: Model 5B and 5C Vega V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
VS – Stalling Speed	72 mph
VSO – Stalling Speed in Landing Configuration	72 mph
Maximum Operating Speed	210 mph
VR – Rotation Speed (Dry Runway, Standard Temperature, Sea Level Pressure Altitude)	83 mph (6,630 lb)



Tip *Amelia Earhart flew a bright red Lockheed Vega 5B, which she eventually sold to the Franklin Institute in Philadelphia. You can read more about Amelia Earhart's life and accomplishments at the official home page at http://www.ameliaearhart.com/. Read more about Wiley Post and* his *Lockheed Vega 5C, nicknamed* Winnie Mae, *at the AcePilots home page at http://www.acepilots.com/post.html.*

Model 5B and 5C Vega Flying Tips

- **Required Runway Length:** 2,500 feet under ISA conditions.
- **Taxiing:** Raise your eye level (Shift + Enter) or toggle the cockpit panel (W) if necessary. Use S-turns as you taxi, and look ahead through the side windows. Use the rudder for directional control. Adjust propeller (Ctrl + F3 until fully forward) and mixture (Ctrl + Shift + F3 until fully forward) *full forward* for taxiing.
- **Takeoff:** Align the Vega with the runway centerline. Advance throttle to *full power* (F4). Apply forward pressure on the control and the tail will rise at 58–60 mph. The Vega will lift off at 75–80 mph. Once clear of runway obstacles, reduce throttle to less than 2,200 rpm (F2 as necessary).
- **Ascent:** Climb at 110–120 mph; your climb speed will decrease with altitude. Set power to 30" Hg of manifold pressure (F2 or F3 as necessary) and propeller speed to 2,100 rpm (Ctrl + F2 or Ctrl + F3 as necessary). Your optimal *cruise* settings are 25" Hg of manifold pressure and 2,100 rpm, at a speed of 140–150 mph.
- **Descent:** Adjust power during your descent to maintain 140 mph (F2 or F3 as necessary). The prop should remain at 2,050 rpm. Reduce airspeed to 85–95 for your approach.
- **Landing:** Plan for a landing speed of 80–85 mph. A wheel landing is preferred.
- **Touchdown:** Once your tail is on the ground, reduce power to *idle* (F2 until idle) and lightly apply the brakes (Period key). Use your rudder for directional control off of the runway.

Tip *The Lockheed Vega is one of two historical planes with an autopilot—which certainly proves its usefulness if you attempt one of Amelia Earhart's long historical flights, such as her solo flight from Los Angeles to Mexico City. The Vega's flight notes provide detailed instructions on using the autopilot. Test it during the first segment of Amelia's flight: Take off and set your autopilot heading to 115 degrees, and your pitch to 10 degrees. Switch on the autopilot to automatically take you to cruising altitude (10,000 feet) and to maintain a heading toward San Diego.*

Piper J-3 Cub

Table 3.11: Piper J-3 Cub Specifications

ITEM	U.S.	METRIC
Maximum Speed	73 kts (85 mph)	137 kph
Maximum Range	190 mi	306 km
Service Ceiling	11,500 ft	3,505 m
Fuel Capacity	12 gal	45.4 L
Maximum Takeoff Weight	1,220 lb	553 kg
Length	22 ft	6.7 m
Wingspan	35 ft	10.6 m
Height	6.7 ft	2 m
Useful Load	540 lb	245 kg

Tip *Build your own model Piper J-3 Cub! Check out the Great Planes model enthusiast Web site for the Piper J-3 Cub at http://www.greatplanes.com/airplanes/gpma0160.html. For further information on the actual Piper J-3 Cub, visit its page at the Smithsonian National Air and Space Museum Web site, at http://www.nasm.si.edu/nasm/aero/aircraft/piperj3.htm.*

ITEM	U.S.	METRIC
Engine	Continental 65 hp Air-Cooled	
Seating	Two	
Total Flight Simulator Aircraft Weight with Full Fuel	1,220 lb	

Table 3.12: Piper J-3 Cub V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
VNO – Maximum Structural Cruising Speed	129 mph
VNE – Never Exceed Speed	122 mph
VS – Stalling Speed	38 mph
VY – Best Rate of Climb Speed (Sea Level)	55 mph
Approach Speed	50 mph
Best Glide Speed	45 mph

Piper J-3 Cub Flying Tips

- **Required Runway Length:** 1,000 feet for takeoff and 1,500 feet for landing. These figures assume a weight of 1,220 lb, a sea level altitude, no headwind, a temperature of 15 degrees Celsius, and a hard runway surface.
- **Taxiing:** Normal power for taxiing is 1,000 rpm (F2 or F3 as necessary). As in most of these historical planes, forward visibility in the Piper Cub is limited. Make S-turns as you taxi, and look out the side windows to maintain course, using your rudders for directional control on the taxiway or runway. Or toggle off the panel (W) for a clear view.
- **Takeoff:** Advance throttle to full power (F4) once the plane is aligned with the runway centerline. At approximately 20 mph the Piper's tail will rise. At approximately 35 mph, ease back on the controller to raise the Piper's nose. The Piper will liftoff at approximately 39 mph.
- **Ascent:** Optimum climb speed for the Piper Cub is 55 mph. Typical cruise settings (at 5,000 feet) are 2,150 rpm (F2 or F3 as necessary), and between 75 and 80 mph.

Tip *The Piper Cub is a classic light aircraft and an excellent training vessel. It flies "low and slow," but is responsive and maneuverable—perfect for applying the concepts learned in the Student Pilot lessons. Test the Piper in the Vin Fiz historical flight, an open-ended flight experience. Just fly your own route from New York to Los Angeles! Remember that the Cub's range is less than 250 miles; frequent stops will be necessary. Toggle the map to locate nearby airports or fields when fuel is low, and read the flight-briefing for refueling instructions.*

- **Descent:** From a typical cruise altitude of 5,000 feet, begin your descent when you're around 15 nm from your destination. Reduce power (F2 as necessary) and maintain a steady descent (approximately 500 feet per minute). Enter the downwind leg of the approach at 75 mph.

Tip Flight Sim *enthusiast Dudley Henriques offers the following advice for the J-3 Cub: The J-3 Cub is one of the most beautiful and easygoing airplanes ever to take flight. Its beauty is in absolute simplicity. Literally, what you see is what you get. Just use the numbers; flying the J-3 is basic "Flight 101." The Cub will float a little bit when you flare for a landing if the approach speed is too high, so watch the speed on final, and don't let it creep up on you. Landings can be accomplished with no brakes if done correctly.*

- **Landing:** Reduce power on final approach; your goal is 55–60 mph. Perform either a three-point or *wheel* landing. For the latter, the key is to touch down lightly on the main gear. (For more on taildragger landings, read over the "Flying Taildraggers" section of the Learning Center.) Once the main gear is down, reduce power to *idle* (F2 until idle) and apply forward pressure on the controller. As the Piper slows, the tail will drop. As it does, keep some back-pressure on the controller.
- **Touchdown:** Use the rudders to maintain directional control after touchdown. Gently apply the brakes (Period key) and slow to taxi speed. Exit the runway.

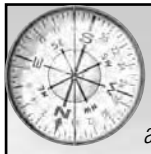
Ryan NYP Spirit of St. Louis

Table 3.13: Ryan NYP Spirit of St. Louis Specifications

ITEM	U.S.	METRIC
Maximum Speed	129 mph	208 kph
Cruise Speed	117 mph	188 kph
Maximum Range	4,000 mi	6,437 km
Service Ceiling	N/A	N/A
Fuel Capacity	450 gal	1,703 L
Maximum Takeoff Weight	5,250 lb	2,381 kg
Length	27 ft, 8 in	8.41 m
Wingspan	46 ft	14 m
Height	9 ft, 10 in	3 m
Engine	One Wright Whirlwind J-5, 223 hp	
Propeller	Hamilton Standard, Two-Bladed, Fixed Pitch	
Seating	One	
Total Flight Simulator Aircraft Weight with Full Fuel	5,250 lb	

Table 3.14: Ryan NYP Spirit of St. Louis V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
Maximum Operating Speed	129 mph
VSO – Stalling Speed in the Landing Configuration (5,250 lb)	71 mph
VSO – Stalling Speed in the Landing Configuration (2,415 lb)	49 mph



Tip *Read more about the Ryan NYP and its historical flight at the Smithsonian National Air and Space Museum's* Milestones of Flight *home page at http://www.nasm.edu/galleries/gal100/stlouis.html. You should also look at the* Charles Lindbergh *home page, which includes information on replica Ryan NYP aircraft, at http://www.charleslindbergh.com/plane/replica.asp.*

Ryan NYP *Spirit of St. Louis* Flying Tips

- **Required Runway Length:** 2,000 feet, in ISA conditions.
- **Taxiing:** Adjust the propeller (Ctrl + F3 until fully forward) and mixture (Ctrl + Shift + F3 until fully forward) to *full forward* for taxiing. You'll quickly discover that there is no visibility in the cockpit. No amount of seat elevation will help! Keep the Ryan NYP an even distance from either edge of the taxiway or runway by peering out the sides of the aircraft. Toggle the cockpit panel (W) or switch to an exterior view if you have trouble taxiing.

- **Takeoff:** Set your flaps between 0 and 20 degrees (F6 or F7 as necessary). Advance throttle to *full power* (F3 as necessary). Maintain rudders for directional control. You'll lift off at approximately 60 mph.

Tip *You can also use the unique periscope built into the cabin of the Ryan NYP to peer outside the plane. It's useful for taxiing. To open the periscope, drag the* periscope handle *to the left with your mouse.*

- **Ascent:** Climb out at 70–80 mph. Maintain this speed to your cruise altitude, which typically will be at around 5,000 feet. Expect a cruising speed of 95–100 mph.
- **Descent:** From your cruise altitude of 5,000 feet, begin your descent when you're 15 nm from your destination (at a rate of 500 feet a minute). Reduce power to prevent the engine from entering redline on the tachometer (F2 as necessary).
- **Landing:** Prepare for a landing speed of 65–75 mph on final approach. Short-field landings are the most difficult, because of the Ryan NYP's lack of forward visibility.
- **Touchdown:** After touchdown, reduce power to *idle* (F2 until idle) and gently apply the brakes (Period key). Use rudders for directional control off the runway.

Vickers F.B.27A Vimy

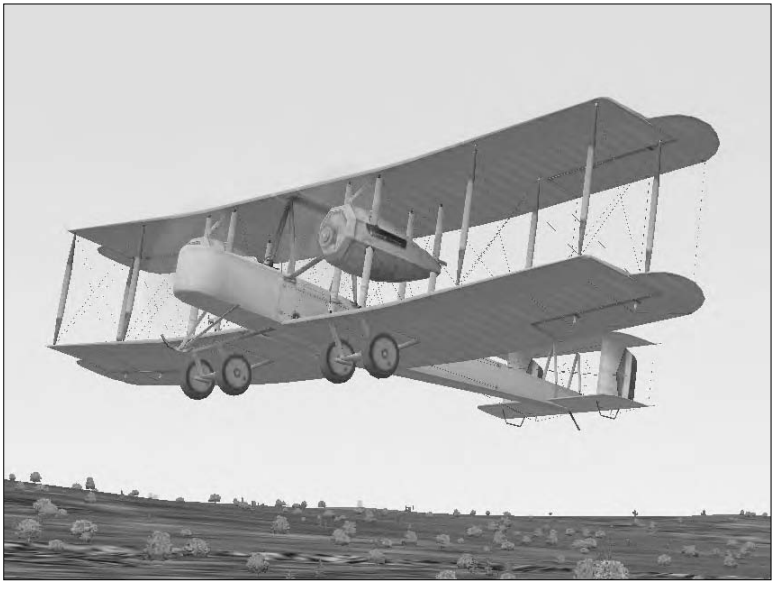


Table 3.15: Vickers F.B.27A Vimy Specifications

ITEM	U.S.	METRIC
Maximum Speed	100 kts	161 kph
Cruise Speed	70 kts	98 kph
Maximum Range	900 mi	1,448 km
Service Ceiling	8,000 ft	2,438 m
Fuel Capacity	865 gal	3,273 L
Maximum Takeoff Weight	13,300 lb	6,033 kg
Length	43 ft, 7 in	13.27 m
Wingspan	68 ft, 1 in	20.75 m
Height	15 ft, 7-1/2 in	4.76 m
Engine	Two Rolls-Royce Eagle VIIIs, 360 hp each	
Propeller	Four-bladed, Fixed Pitch, Wood	
Seating	Two	
Total Flight Simulator Aircraft Weight with Full Fuel	13,300 lb	

Table 3.16: Vickers F.B.27A Vimy V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
VS – Stalling Speed	40 mph
VNE – Never Exceed Speed	98 mph

Tip *A restoration and recreation project for the Vimy is underway. For details, head over to http://www.vimy.org/home.html, a home page for the Vimy Aircraft Project. The organization is dedicated to recreating the first direct crossing of the Atlantic, by John Alcock and Arthur Whitten-Brown, in 1919—a flight that you can experience in* FS 2004*! The new real-world flight is set for June 2004.*

Vickers F.B.27A Vimy Flying Tips

➢ **Required Runway Length:** 2,000 feet, with ISA conditions. The Vimy can lift off at around 600 feet but it climbs so slowly that 2,000 feet is typically required to clear obstacles higher than 50 feet.

- **Taxiing:** The Vimy can be difficult to manage on the ground—it's hard to see out of the narrow cockpit. If you have trouble on the taxiway, look 45 degrees out the side window, remove the cockpit panel, or switch to *spot plane* or *top down* view. (Press the S key to cycle views or Ctrl + S to toggle the top-down view.)
- **Takeoff:** Align the plane with the runway centerline, lock the tail wheel (Shift + G) and advance the throttles smoothly to *full power* (F3 as necessary). Apply back-pressure on the controller as the Vimy accelerates. At 40–45 mph, the Vimy will take off. Maintain your low altitude until the Vimy increases speed to around 69 mph.

Tip *The* FS 2004 *Vimy historical flight, "England to Australia Race," provides an excellent opportunity to test the Garmin 295 handheld GPS navigation. The briefing suggests stops for this 136-hour flight, and you can input these stops as* waypoints *into the GPS. Display the handheld GPS by pressing Shift+3, click the* waypoint *button, and enter a stop—for instance "LFLY," Bron Airport in Lyon, France. Follow the GPS indicators toward the stop.*

- **Ascent:** A fully loaded Vimy climbs at 1,000 feet…an hour! You can reach 4,000 feet in four hours then 6,000 feet in another hour, and finally 8,000 feet in around six hours. Climb speed is about 69 mph; gauge your altitude by looking at the aircraft's relation to the real horizon. Maintain cruise power at approximately 1,800 rpm (F2 and F3 as necessary).
- **Descent:** Normal descent speed is similar to climb and cruise speed: 60–70 mph. Reduce throttle (F2 as necessary) to maintain a controlled descent.
- **Landing:** Plan for a landing speed of 60 mph. Keep the engine at 2,000 rpm, near idle speed (F2 as necessary).
- **Touchdown:** Pull power back to *idle* once you're over the runway, and complete a three-point landing (for more on a three-point landing, check out "Flying Taildraggers" in the Learning Center). The Vimy has no brakes, so don't land *long* (at the far end of the runway).

1903 Wright Flyer

Table 3.17: 1903 Wright Flyer Specifications

ITEM	U.S.	METRIC
Maximum Speed	30.4 kts (35 mph)	56 kph
Service Ceiling	< 30 ft	< 9 m
Fuel Capacity	.25 gal	.95 L
Length	21 ft	6 m
Wingspan	40 ft	12 m
Wing Area	510 sq ft	155 sq m
Engine	One 12 hp Wright Engine	
Seating	One	
Total Flight Simulator Aircraft Weight with Full Fuel	750 lb	

Tip *Visit the AAIA Wright Flyer Project at http://www.wrightflyer.org/. This organization is honoring the Wright Brothers by building and flying a modern representation of the 1903 Wright Flyer. The fascinating Web site offers plenty of historical and background information, as well as progress reports and even downloadable movies of the organization's accomplishments, at http://www.wrightflyer.org/Movies/.*

Table 3.18: 1903 Wright Flyer V-Speeds

V-SPEED	AIRSPEED IN MILES PER HOUR (MPH)
Maximum Operating Speed	35 mph
VSO – Stalling Speed in Landing Configuration	23 mph

1903 Wright Flyer Flying Tips

- **Required Runway Length:** The Wright Flyer has no landing gear; it was launched from a rail on takeoff, and landed in an open field on its skids. The "runway" length required is little more than the length of the aircraft itself (21 feet).
- **Taxiing:** There is no taxiing in the Wright Flyer. Use the *Slew* function in *FS 2004* to move the Flyer horizontally across the ground, if necessary. (Consult the "Positioning Your Aircraft" section of the Learning Center.)
- **Takeoff:** Normal takeoff is from a launch rail designed for the Flyer. Use the launch rail (use the *Select a Flight* screen and choose *First Flight*) or use the Slew feature to position the Wright Flyer. You can also set your altitude and airspeed in the map. Click on the *World* menu and click *Map View*. Then enter the altitude and airspeed in their appropriate boxes. See how long you can keep it airborne!
- **Ascent:** The Wright Flyer doesn't climb.
- **Descent:** The Wright Flyer can't gain enough altitude to "descend." Just make sure the field is open for touchdown!
- **Landing:** The Wright Flyer lands on wooden skids. Keep the plane straight as you "descend" and land. Reduce speed on landing approach.
- **Touchdown:** Don't flare the Wright Flyer. After touchdown, the friction will stop the airplane.

CHAPTER 4
The Learning Center

The beauty of* Flight Simulator *is that it enthralls* everyone. *Beginners can embark on sightseeing adventures, while advanced pilots can study GPS navigation or IFR at 30,000 feet. The number of possible flight experiences is virtually limitless.

Everyone's journey through* Flight Simulator 2004: A Century of Flight *should begin at the Learning Center. This is a fabulous new feature in which Microsoft has documented every aspect of its deep and wide-ranging simulation. This chapter highlights key portions of the Learning Center documentation, including the* flight plan *that guides novice, intermediate, and advanced fliers alike to necessary information; a breakdown of new* Flight Simulator *features; and a guide to first flights for novices.

Navigating the Learning Center

The Learning Center is your portal to the *Flight Simulator 2004* database. The information within includes documentation, tutorials, extensive background on historical aircraft, a guide to the menu system, and much more. Learning Center data runs the gamut from the basics of flight to advanced pilotage and navigation concepts.

Note *Although this chapter offers important tips both for intermediate and advanced* Flight Simulator *pilots, the "Getting Airborne" section is primarily applicable to beginners. If you're comfortable with flight basics, turn your attention to "Flight Plan for Intermediate and Advanced Pilots," later in this chapter, to see what parts of the Learning Center, and this strategy guide, will be helpful to you.*

To activate the Learning Center, click on the *Learning Center* option on the *FS 2004* Main Menu bar (see Figure 4.1). The wealth of information found within can be daunting, particularly to first-time *Flight Simulator* pilots. But fear not: This section provides a few tips for navigating the Learning Center for novice and advanced pilots alike. And we'll match Learning Center topics as we give you additional information and present you with some challenges.

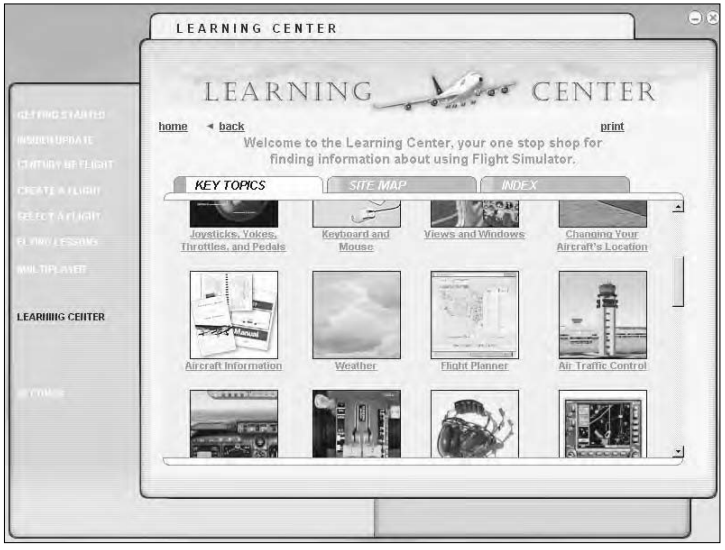


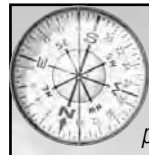
Figure 4.1: *Embark on your* Flight Simulator *adventure at the Learning Center.*

Flight Plan for Novice Pilots

If you're a flight-simulation "student pilot," or consider yourself a novice even though you've enjoyed a previous version of *Flight Simulator*, make the Learning Center your first destination upon launching *FS 2004: A Century of Flight*.

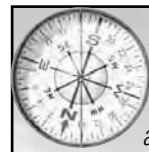
This section of our guide will help beginners get the most out of their visits to the Learning Center. Listed below are some key sections in which to begin your journey.

- **Step-by-Step Guide:** Visit this Learning Center section first. It provides instruction on the menu choices in *FS 2004*. As you'll read in this guide, the "Getting Started" area is ideal both for those new to flight simulation and for those eager to see what's new. (You can take a simple introductory flight if you'd like to get into the air quickly. We'll have more on that later in this chapter.) Read the overview and watch the video from John and Martha King for a guide to the simulation's features. The "Century of Flight" section leads you to information about *FS 2004's* new historical aircraft, and to Lane Wallace's magnificent essays. "Select a Flight" and "Create a Flight" can get you into the air quickly, but novices should first consider Rod Machado's "Flight Lessons" section, particularly the Student Pilot tutorials.
- **Optimizing Visuals and Performance:** Fine-tuning your computer system, as well as *FS 2004*'s numerous details and hardware options, will dramatically enhance your simulation experience. Consult this section when deciding how to adjust the many settings that increase the simulation's performance, i.e., your frame rate. You also will find ways to tweak your own system to improve its performance. See also Chapter 1, "Systems Checklist," in this guide, for additional optimization tips and further explanation of detail settings.



Tip *The Glossary is one of the most important features of the Learning Center: It will assist pilots at any level. If you're curious about any term or concept mentioned in this guide, anywhere in the Learning Center, or elsewhere in* FS 2004: A Century of Flight, *go to the Glossary, located at the bottom of the Learning Center menu. Once you have opened the Glossary, use the letter shortcuts at the top of the page to jump toward the term you need defined.*

- **Basic Aerodynamics and Maneuvers:** Novices should explore this Learning Center section, which covers the basic elements of flight and flying. In this section you'll learn the aerodynamic principles behind flight—the *four forces of flying*—and you'll find quick coverage of straight-and-level flight, turns, climbs, descents, and stalls. A careful reading of this section is good preparation for the "Student Pilot" lessons in the "Flight Lessons" section. A deeper understanding of these concepts can be found in the "Cockpit Basics" and "Controlling the Engine" sections (see later in this chapter) of the Learning Center. An understanding of these basic concepts is also highly recommended before attempting the challenges found throughout Chapters 5 through 8 of this guide.
- **Sections on Controllers:** Your choice of controller will affect the simulation's realism significantly. Although *A Century of Flight* can be enjoyed with mouse and keyboard, those seeking a more realistic experience should consider advanced joysticks, flight yokes, and rudder pedals. The Learning Center's two sections on controllers provide instruction on changing command assignments, on calibration, and on the use of the mouse on the cockpit (and virtual cockpit) panel. Chapter 1 of this guide, "Systems Checklist," elaborates on simulation controllers, and offers specific suggestions. See Appendix C for a complete keyboard command reference.

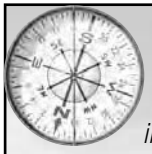


Note *Microsoft's* Flight Simulator *Insider Web site, at http://zone.msn.com/flightsim/ is another valuable resource. The site houses many useful articles and helpful tutorials for sim pilots of every ability. For more on the Flight Simulator Insider website, turn to Chapter 10, "Flight Simulator Community."*

➢ **Getting Help on the Fly:** It's easy to get the help you need, even in the middle of a flight. If you're new to *Flight Simulator*, read this section of the Learning Center, and you'll know how to get help quickly. The section explains *rollover* help and *tooltips* (move your mouse pointer over a button or panel object for further explanation or identification), and the basics of the *kneeboard* (see Figure 4.2).

Figure 4.2: *The* kneeboard *(F10) comprises important flight data, such as pre-configured flight briefings, the ten-most-recent ATC messages, and your navigation log.*

➢ **Views and Windows:** Your eyes aren't restricted to the path ahead of you. Learn about your viewing options. You can peer out side windows or change to *spot plane* (exterior) view to see your aircraft from the outside. Creating and utilizing additional windows (screens) is also covered in the section.



Tip *Manipulating windows can add a personal touch to your flight screen. You can resize any window, including the primary view, to make room for subpanels showing your GPS, radio stack, or engine controls. Pressing the [key opens an additional view window, in which you can change the view option. For instance, you can use a* top down *or* spot plane *view to help with skills, as when watching your plane's pitch on takeoff or landing. You can open as many windows as your computer can handle. Close windows with the] key, which closes the last window opened first.*

➢ **Cockpit Basics and Controlling the Engine:** Both of these areas add depth to the "Basic Aerodynamics and Maneuvers" Learning Center section described earlier in this list. These sections should be a novice's bridge into a more advanced simulation. You can directly apply the concepts presented in these sections when you take further flight tutorials, particularly the "Private Pilot" lessons.

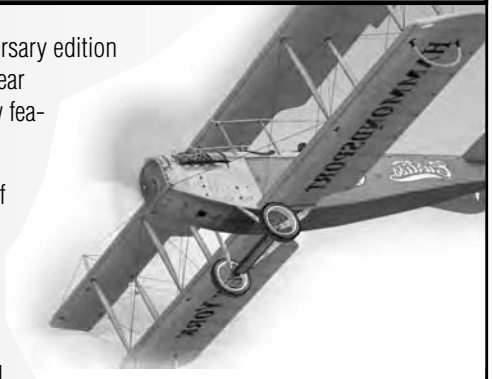
Flight Plan for Intermediate and Advanced Pilots

Those comfortable with the basics of flight, the six primary flight instruments, and the control scheme will want to stretch their wings using the more advanced features of *Flight Simulator 2004*. This section of our guide will help more experienced players navigate through the Learning Center, as we point out key sections that will enhance your *FS 2004* experience.

➢ **Aircraft Information:** Everyone should read this section, which includes detailed background information and statistics for all the aircraft used in *FS 2004* (see Figure 4.3), both modern and historical. The *kneeboard* (F10 during flight) also offers important aircraft data and checklists. Much of this information has been compiled and even enhanced in this guide's Chapter 2: "Modern Aircraft Reference," and Chapter 3: "Historical Aircraft Reference." See Appendix B for complete taxi-to-landing checklists for all these aircraft. Use these chapters for reference, and to better understand the concepts presented in other areas of this guide. If needed, consult the Glossary for definitions of terms used throughout these chapters and in this Learning Center section.

New Flight Simulator *Features*

Microsoft has implemented exciting new features for its 20th-anniversary edition of *Flight Simulator*, which also happens to commemorate the 100-year anniversary of the Wright brothers' first flight at Kitty Hawk. Key new features include:



➢ Scenery improvements: Many graphical details and elements of scenery have been improved, such as taxiway and runway signs, enhanced auto-generated 3-D objects, airports, and lightning, sky, and clouds.

➢ Virtual cockpits: You'll have an enhanced virtual cockpit view, in which you can tune radios and adjust knobs by pointing and clicking.

(continued on next page)

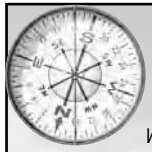
New Flight Simulator *Features (continued from previous page)*

- Enhanced Air Traffic Control: ATC has been significantly upgraded in *FS 2004.* Among the added features are traffic to all (including non-controlled) airports; precision and non-precision approaches to multiple runways; pop-up IFR clearances; and more.
- Enhanced GPS: Two models, the Garmin 500 and 295 series, are available, featuring color moving maps, and airport and facility information.
- Improved map: The map view is full-color, with terrain display and rollover mouse information.
- Learning Center: This is the *very* useful interactive "Web site on a disk," with additional tutorials and documentation.
- New weather options: The most significant new feature of *FS 2004* is your increased ability to customize the weather. You can use the new dynamic weather system and alter the rate at which weather changes. You can choose one of several weather themes to set up challenging weather with just a couple of mouse clicks. You can set real-world weather settings at Static—a snapshot of the conditions around the world that remains unchanged—or Update, an option in which weather conditions are updated every 15 minutes for the area 50 km around your aircraft. And finally, you have the ability to set the weather at individual weather beacons for a highly configurable flight experience. For more on weather, see Chapter 5: "From Taxi to Takeoff," on setting up a new flight.

- **Flying Specific Craft:** The Learning Center provides in-depth flying tips for specific *types* of aircraft, including *taildraggers* (applicable to the historical planes), twin-engine planes, floatplanes, jets, and helicopters (see Figure 4.3). To get the most out of this section, make sure you have a good understanding of the Learning Center sections described in the "Flight Plan for Novice Pilots" section earlier in this chapter. You'll also find Chapters 2 and 3 of this guide handy as a quick reference when flying, but this Learning Center area will give you the most detail.

Figure 4.3: *The Learning Center offers specific sections on particular types of aircraft.*

➢ **Flight Planner, Navigation, GPS, and Autopilot:** Tackle these advanced topics with a *threefold* approach. Use these Learning Center sections to grasp the facts of each topic; fly specific tutorials that help demonstrate these topics (such as Rod Machado's "VOR Navigation" lesson); and then use the *challenges* presented in this guide to apply what you've learned under a variety of conditions. For example, Chapter 6: "In-Flight Navigation" offers challenges for VFR flight, VOR, ADF/NDB, and GPS navigation, and use of the autopilot.



Tip *Chapters 4 through 8 of this guide further demonstrate the topics covered in the Learning Center's "Flight Planner," "Navigation," "GPS," and "Autopilot" sections. For example, Chapter 5: "From Taxi to Takeoff" covers flight plans and navigation logs; Chapter 7: "Approaches and Landings" challenges you with specific VFR and IFR approaches; and Chapter 8: "So You Want To Be A…" uses this material in role-playing scenarios such as* bush pilot *and* airline pilot *flying.*

➢ **Air Traffic Control:** The Learning Center provides an in-depth section on Air Traffic Control (ATC), which even features its own specific section glossary. The role of Air Traffic Control is enhanced in this version of *Flight Simulator,* with in-flight IFR plans, new approach requests, and ATC instructions that appear on the kneeboard during flight. "Introduction to Flight Simulator ATC" covers these enhancements and steers novice and advanced users to applicable topics in the detailed ATC section of the Learning Center. You'll also find ATC areas in this guide's Chapters 4 through 8, in which we elaborate on ATC procedures as part of each chapter's topics.

➢ **Weather:** The Learning Center's section on weather will enhance your simulator experience exponentially. Not only will the challenge increase, you'll witness the glorious weather and cloud effects available in this version. *FS 2004* features many "weather" enhancements, including a dynamic weather slider that determines the rate at which weather changes over time, and weather *themes* to customize challenging conditions with just a few menu clicks (see Figure 4.4). For more on weather, see Chapter 1: "Systems Checklist" for a rundown of weather display options, and be sure to read the sidebar on new weather features earlier in this chapter.

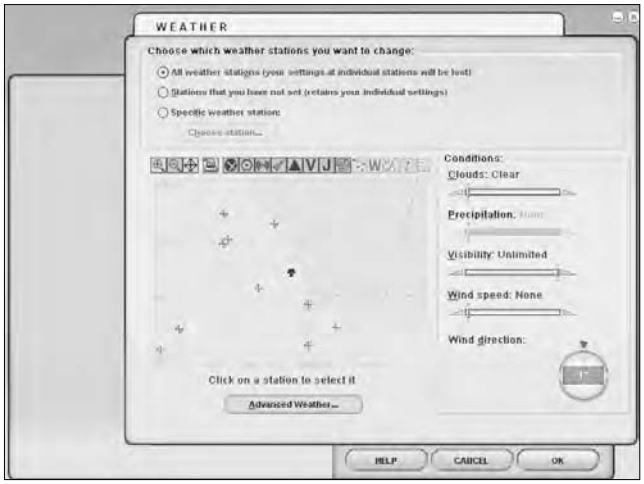


Figure 4.4: *The new* Flight Simulator *lets you dramatically "customize" the weather, to experience flying in various conditions.*

➢ **Flight Simulator as a Training Aid:** Written by Bruce Williams, business development manager for Flight Simulations at Microsoft and a pilot for more than 25 years, this Learning Center section offers advanced users who are taking real-world flight lessons a guide to the use of *FS 2004* as a training aid. This is an extremely informative section, and a must-read for any user thinking about making the transition from *Flight Simulator* to real-life lessons.

As you can see, the Learning Center is a comprehensive, highly interactive teaching tool for every sim pilot. We've highlighted what we think are the most important sections, but you'll find many other areas useful, including more information on the various *phases* of flight, and on such utilities as *instant replays* and *flight videos.* Use the tabs at the top of the Learning Center screen to select the index or site map, and scan for the section you'd like to read.

Getting Airborne

This section offers guidance both to new pilots who want to get in the air quickly and veterans who want to customize a challenging flight. We strongly suggest that novices begin with Rod Machado's "Flying Lessons" section and the "Student Pilot" tutorials. Here you'll find a rundown of each student-pilot lesson, tips on obtaining your first flight certificate, and instruction on where your interactive learning path should take you next. More experienced users should skip ahead to "Creating a New Flight," which covers the ins and outs of setting up a flight, including the new weather options offered in *FS 2004*.

Student Pilot Tutorials

Getting into the air quickly through the Learning Center is easy: Click "Getting Started." Next, select "Introductory Flight." Here you'll find short instructional videos on the controls and the basic flight instruments, presented by instructors Martha and John King. Watch the videos, follow the instructions, and you're up in the air in no time, on a basic flight in a Cessna 172.

These quick overviews will certainly provide enough info for some leisurely sightseeing, but a more in-depth experience can be found in the "Flying Lessons" section (see Figure 4.5). Enter the section and begin your journey through *Flight Simulator* with Rod Machado and the "Student Pilot" tutorials. The following list describes each lesson, what you should take from it, and how to apply the lessons learned as you turn to other parts of the Learning Center and this book.

Figure 4.5: *A beginner should enroll in Rod Machado's student-pilot sessions in the "Flying Lessons" section.*

- **Lesson 1: Straight and Level Flight.** This lesson covers the *four forces of flight*—the laws of physics that allow an aircraft to fly—and how your cockpit controls affect *pitch* (up and down movement) and *bank* (left and right movement), and the subsequent result in terms of your instrument readings. The Learning Center's "Basic Aerodynamics and Maneuvers" and "Cockpit Basics" cover similar topics. Take note on the lesson's section on *trim* and how it is used to maintain level flight without pressure on the controls.

Tip *Beginners should keep the* Realism *setting to the preset "easy" level for at least the first few lessons and solo flights. You'll notice that this automatically sets* Unlimited Fuel *on, so you can enjoy your flight experiences without concern for a required landing. Autorudder is also set to* on, *which enables automatic coordination of ailerons (which turn the aircraft) and rudders.*

- **Lesson 2: Turns.** Here you'll learn to use your ailerons and rudders to turn the plane, and how much pressure to put on the controller. You'll also learn how to monitor the *attitude* indicator to gauge your degree of turn, and how to follow a heading using the directional gyro. As with Lesson 1, consult the Learning Center's "Basic Aerodynamics and Maneuvers" and "Cockpit Basics" for more coverage of these topics.
- **Lesson 3: Climbs and Descents.** This lesson teaches you how power and *climb angle* affect your speed both in climbs and descents. You'll also discover the appropriate controller pressure when maintaining an ascent or descent. Learn more about these subjects in the "Cockpit Basics" and "Controlling the Engine" sections of the Learning Center. Practice these concepts before attempting the challenges presented in Chapter 5: "From Taxi to Takeoff" and Chapter 7: "Approaches and Landings."

- **Lesson 4: Slow Flight.** This lesson illustrates the importance of *slow flight,* specifically how to use the *trim* to maintain level flight at idle speed. This topic is tied directly into approaches and landings, so apply your lesson here to the challenges presented in Chapter 7. Consult "Cockpit Basics" and "Controlling the Engine" for additional information.
- **Lesson 5: Takeoffs.** Here's a straightforward lesson—you'll learn to take off. After flying this lesson, see Chapter 5: "From Taxi to Takeoff" for additional information on pre-flight planning and specific takeoff challenges. You also should consult Chapters 2 and 3 for takeoff tips regarding each modern and historical aircraft.
- **Lesson 6: Landings.** Getting back down is more complex than getting up. Here you'll apply concepts that can be found throughout the "Basic Aerodynamics and Maneuvers," "Cockpit Basics," and "Controlling the Engine" sections of the Learning Center. Take special note of the section on using flaps, which is further covered in "Cockpit Basics." After completing this lesson, see Chapter 7: "Approaches and Landings" for more information and specific landing challenges.

Upon completing the student-pilot lessons, you can create your own similar training sessions, but with added challenge (see Figure 4.6). For instance, let's set up an alternate takeoff challenge. Select *Create a Flight* from the menu options. Choose the Cessna 172 as your selected aircraft (the same flown in the student pilot lesson). Next, change the selected location and input *KPWT* into the *airport ID* box. This is Bremerton National Airport, the same used in the student-pilot challenge. Select *runway 19* in the *starting position* box.

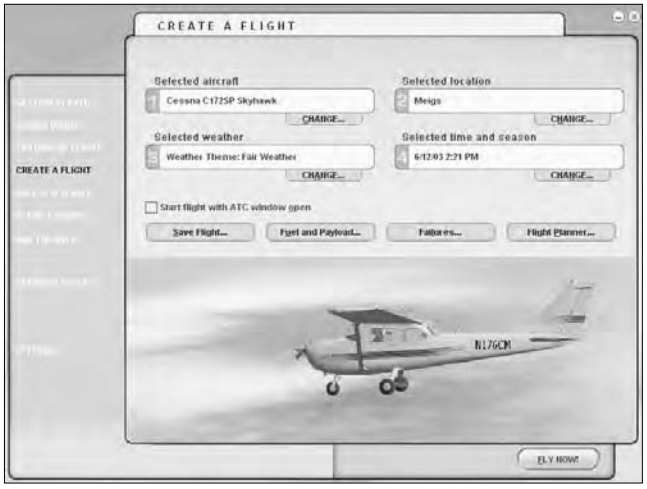


Figure 4.6: *Set up additional lessons using the "Create a Flight" option, and customizing the time and weather.*

Now here's the fun part—it's time for additional challenge. For starters, you can change the time. For example, setting up the takeoff at night. You can also experiment by changing the selected weather. Choose a weather theme other than *Clear Skies* and see how the experience changes. If you'd prefer to customize it further, select *User-Defined Weather* and then *Customize Weather*, where you can select visibility, precipitation, and wind speed and direction (like add a crosswind by rotating the wind direction to 100 or 280 degrees).

Your First Solo Flight

The seventh lesson in the student-pilot tutorials is your first solo flight. Rod Machado will provide some maneuvering instructions, but you're alone to apply the concepts learned throughout the previous six student pilot lessons. This section of the guide will take you through this first solo flight and through the landing, where you'll receive your first certificate.

You begin inside the Cessna 176, on active runway 19 at Bremerton National Airport. The skies are clear—perfect for your first solo flight. Set your throttle to *idle* to calibrate the controls (using your controller's throttle mechanism or pressing F2 on the keyboard). Listen to Rod's initial instructions. He'll provide heading change instructions during the flight.

The table immediately following shows Rod's requirements for the flight. You're expected to keep within these requirements to obtain your flight certificate. Stay out of these ranges for too long and you could fail the solo flight.

Solo Flight Requirements

ITEM	REQUIREMENT
Altitude	± 100 feet
Airspeed	± 10 knots
Heading	± 10 degrees
Pitch Attitude	± 3 degrees
Turns	± 10 degrees of 20 degrees

Release the parking brake (Period key), align the plane with the runway's centerline, and increase the throttle to *full power* (F3). Apply back-pressure on the controller and lift off at approximately 55 knots. Climb at a 10-degree pitch, at a heading of 190 degrees, at 80 knots. Ascend to a cruise altitude of 1,500 feet. Once at 1,500 feet, reduce power (F2) to maintain a cruise speed of 85 knots. Adjust trim as necessary to maintain level flight at reduced power.

Rod will instruct you to turn 90 degrees left, to a new heading of 100 degrees (the heading bug automatically moves to the heading Rod specifies).

Maintain level flight at 1,500 feet and wait for Rod's next instruction—another 90-degree left turn to a heading of 10 degrees. You're now flying in the opposite direction to that in which you'll be landing. Look at 45 degrees out the left window and you'll spot the Bremerton runway (see Figure 4.7).

Tip *Apply the techniques learned on* turns *during Lesson 2 when banking to the new heading. You may need to pitch slightly up to maintain cruise altitude. To establish the 20-degree bank, roll the plane left until the second white bank mark rests over the orange triangle, and begin to level the plane as you approach the 100-degree heading.*

Figure 4.7: *After your second 90-degree turn, you're flying toward the runway, which is to your left.*

Rod instructs you to adjust flaps to 10 degrees when the runway is directly to your left (hit F7 once). Descend to 1,300 feet as instructed, while maintaining the same heading. You must perform two more 90-degree left turns, the first to a heading of 280 degrees and the last one to a heading of 190 degrees.

You're now on final approach. You probably will need to make adjustments to your position, altitude, and speed to line up with the runway. (Rod will likely offer his advice.) As you plan your descent you might discover that you're too low, in which case you should increase power and hold altitude. If you're too high, decrease altitude. Plan for a landing speed of 60–70 knots. When you're just over the runway, reduce power to *idle* (F2), raise the nose up a bit, and gently drop to the runway. Smoothly apply brakes (Period key) and come to a complete stop. Congratulations on your solo student-pilot certificate!

Now recreate your first solo flight with more challenging settings! Use the Create a Flight menu and choose Cessna 172 as your plane, Bremerton National Airport (KPWT) as your airport, and runway 19. Take your choice of time, season, and weather conditions. Try the *Gray and Rainy* weather theme at dawn; customize your weather with precipitation and wind, or simply decrease visibility by adding fog. As a learning tool, attempt this custom solo flight in a variety of conditions and aircraft. Rod won't be there to assist, so just follow the same guidelines you did in the student-pilot solo flight to complete the challenge.

CHAPTER 5
From Taxi to Takeoff

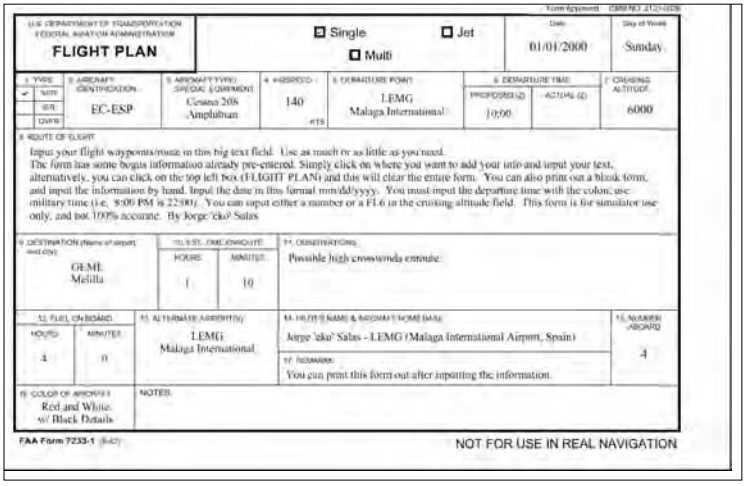
Preparing a flight plan is the first step toward getting airborne. Use* Flight Simulator*'s Flight Planner to set* start *and* destination *airports, receive important navigational data, and even "sync" the planner with your aircraft's GPS unit. From there it's on to the taxiway, and—in a taildragger—the challenge of taxiing. And finally, you're at the runway, going through your checklist in preparation for takeoff.

This chapter will cover preflight planning, using* FS 2004*'s Flight Planner to set up a variety of VFR and IFR flights. It also covers taxiing your aircraft from gate to runway and performing successful takeoffs in historical and modern aircraft. We have a challenge—a difficult takeoff scenario—but we'll walk you through the entire process.

Flight Planning

In *Flight Simulator 2004* you can create flight plans to suit your skill level or desires using the *Flight Planner.* You can make a flight as simple (Direct-GPS routing) as or as complex (adding a variety of waypoints) as you wish.

The Flight Planner is also the hub of everything you need to know about your flight, including navigational map that indicate airports, VORs, NDBs, and terrain features; navigation aids such as VOR and ILS frequencies; and a navigation log (navlog) that keeps track of estimated fuel consumption and time of flight. It's all included in the Flight Planner—and you won't have to fill out any paperwork to get off the ground (see Figure 5.1).



FLIGHT PLAN

☐ Single ☐ Jet ☐ Multi

01/01/2000 — Sunday

3 AIRCRAFT IDENTIFICATION	4 AIRSPEED	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	6 DEPARTURE TIME ACTUAL (Z)	7 CRUISING ALTITUDE
EC-ESP	140 KTS	LEMG Malaga International	10:00		6000

3 AIRCRAFT TYPE / SPECIAL EQUIPMENT: Cessna 208 Amphibian

8 ROUTE OF FLIGHT

Input your flight waypoints/route in this big text field. Use as much or as little as you need.
The form has some bogus information already pre-entered. Simply click on where you want to add your info and input your text, alternatively, you can click on the top left box (FLIGHT PLAN) and this will clear the entire form. You can also print out a blank form, and input the information by hand. Input the date in this format mm/dd/yyyy. You must input the departure time with the colon; use military time (i.e. 8:00 PM is 22:00). You can input either a number or a FL6 in the cruising altitude field. This form is for simulator use only, and not 100% accurate. By Jorge 'cko' Salas

9 DESTINATION	10 EST. ENROUTE HOURS	10 EST. ENROUTE MINUTES	11 OBSERVATIONS
GEML Melilla	1	10	Possible high crosswinds enroute.

12 FUEL ON BOARD HOURS	12 FUEL ON BOARD MINUTES	13 ALTERNATE AIRPORT(S)	14 PILOT'S NAME & AIRCRAFT HOME BASE	15 NUMBER ABOARD
4	0	LEMG Malaga International	Jorge 'cko' Salas - LEMG (Malaga International Airport, Spain)	4

16 REMARKS: You can print this form out after inputting the information.

17 COLOR OF AIRCRAFT: Red and White w/ Black Details

NOTES:

FAA Form 7233-1

NOT FOR USE IN REAL NAVIGATION

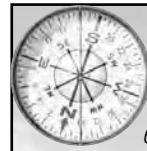
Figure 5.1: *Here's a sample of a real-world flight plan. Fortunately,* in Flight Simulator 2004*, you won't be filling out a lot of paperwork. Just use the Flight Planner!*

This section elaborates on the difference between VFR (Visual Flight Rules) and IFR (Instrument Flight Rules) and how that relates to the Flight Planner. This information also is covered in depth in the Learning Center. We'll give you direction in this section to vital Learning Center documentation on the Flight Planner's features. We also give you a few tips here on creating your own flights.

VFR vs. IFR

VFR and IFR are the two primary methods of navigation from which all other forms of navigation derive. VFR flying essentially is navigation through *visual* means, using landmarks or roads to determine your position. VFR flight is only permitted during clear weather conditions. That's self-explanatory—if visibility were just one mile, it would be virtually impossible—not to mention illegal—to navigate this way.

IFR stands for Instrument Flight Rules—under IFR a pilot flies solely by reference to the instruments, and Air Traffic Control is responsible for keeping aircraft separated. Instead of following landmarks on the ground, pilots flying under IFR navigate using VOR (Very-high-frequency Omni Range), ADF (Automatic Direction Finder), or GPS (Global Positioning System) receivers. Both visual and instrument navigation are covered thoroughly in the Learning Center, under the "Navigation" heading. You also can learn more about several types of navigation in this guide's Chapter 6: "In-Flight Navigation." The chapter also features specific navigation challenges, with direct instruction to help you master these concepts.



Tip *For more on VFR and IFR flight, see Chapter 6: "In-Flight Navigation." You'll find in-depth explanations of both visual and instrument navigation, and numerous examples and challenges for both types of navigation—in a variety of conditions and aircraft. And search the Learning Center under "Navigation" for even more information about VOR, GPS, and ADF for instrument flights, and—under "Old-Fashioned Navigation"—about VFR flights.*

Navigation, whether VFR or IFR, directly relates to flight planning because you must file a *flight plan* if you are flying IFR (either because of given conditions or because of your desired cruising altitude). Air Traffic Control will not provide clearance for an instrument flight without an issued flight plan. The following table shows cruising altitudes for VFR and IFR flights. Flights above 18,000 feet, or *FL180,* are IFR only.

Table 5.1: VFR and IFR Cruising Altitudes

TYPE	HEADING	CRUISING ALTITUDE
VFR (3,000 ft to 18,000 ft)	000-179	Odd Thousands Plus 500 ft (i.e.: 3,500, 5,500, 7,500, 9,500, 11,500, 13,500, 15,500, 17,500)
VFR (3,000 ft to 18,000 ft)	180-359	Even Thousands Plus 500 ft (i.e.: 4,500, 6,500, 8,500, 10,500, 12,500, 14,500, 16,500)
IFR (3,000 ft to 18,000 ft)	000-179	Odd Thousands (i.e.: 3,000, 5,000, 7,000, 9,000, 11,000, 13,000, 15,000, 17,000)
IFR (3,000 ft to 18,000 ft)	180-359	Even Thousands (i.e.: 4,000, 6,000, 8,000, 10,000, 12,000, 14,000, 16,000)
IFR Only[1] (FL180[2] to FL290)	000-179	Odd Thousands (i.e.: FL190, FL210, FL230, FL250, FL270)
IFR Only[1] (FL180 to FL290)	180-359	Even Thousands (i.e.: FL200, FL220, FL240, FL260, FL280)
IFR above FL290	000-179	Every Other Odd Flight Level, Starting at 29,000 ft, with 4,000 ft Intervals (i.e.: FL290, FL330, FL370, FL410, FL450, etc.)
IFR above FL290	180-359	Every Other Odd Flight Level, Starting at 31,000 ft, with 4,000 ft Intervals (i.e.: FL310, FL350, FL390, FL430, FL470, etc.)

[1] No VFR aircraft allowed at or over 18,000 feet.

[2] FL stands for flight level, a cruising altitude designation in hundreds of feet. FL180 stands for 18,000 feet.

Flight Setup

This section walks you through the process of setting up a flight using *Flight Simulator*'s Flight Planner. Choose the *Create a Flight* option from the Main Menu. Next, select the *Flight Planner* button to open the planner.

Your first decision regards your departure location. Choose the *Select* button underneath the *Departure Location* heading to open the *Select Airport* menus. You can search the entire database by selecting *All* for country/region, state/province, and city. If you've already tinkered with these options and would like to quickly reset them to *All*, just press the *Clear Filter* button.

Search for airports by name, ID, or city. As you type in letters or numbers, the search results automatically shift to what you've entered so far, making the task much easier (see Figure 5.2). If you've installed add-on airports and scenery, toggle the *Search Add-On Scenery* button to search only add-on airports. When you're finished, select a *destination* airport in a similar fashion.

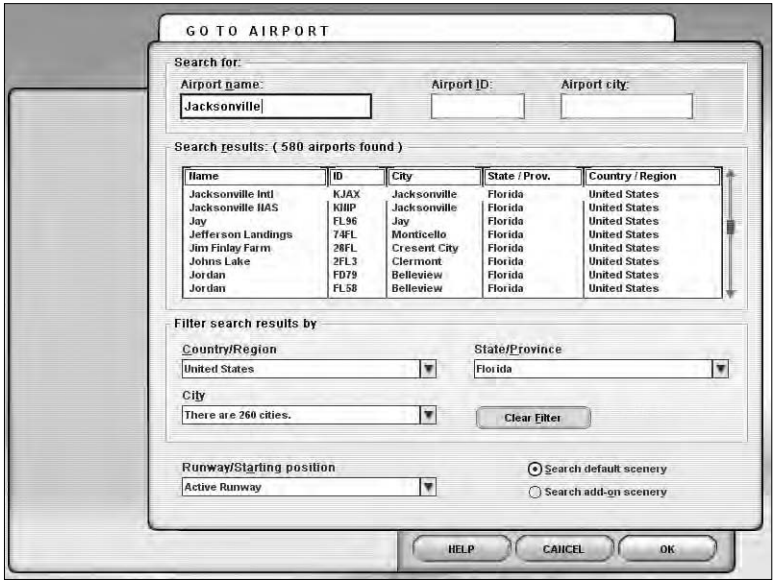


Figure 5.2: *You can filter departure and destination airports by country, state, and city—or just start typing its name or ID.*

Choose your navigation type: either visual (VFR) or instrument (IFR). If you choose IFR, you must then choose *routing. Direct-GPS* creates a direct course; *low and high altitude airways* creates a course through the designated airway; and *VOR-to-VOR* plots a flight plan using VOR signals between your departure and destination locations. See Chapter 6: "In-Flight Navigation" for more on these and other navigation types.

Now you can edit your flight plan, should you wish to make alterations. Choose *Find Route* in the *Plot Flight Plan* section to switch to the *Edit* tab. The plentiful options at the top of the *Edit* screen allow you to customize your navigation map by toggling items such as airports, VORs, NDBs, ILS runways, high- and low-altitude airways, airspace designations, and weather stations. The Learning Center offers explanations of each button, or you can "hover" your mouse over each icon to discover its use.

Tip *With the* Edit Flight Plan *option loaded, click your mouse on an airport to open a window containing important information about that airport, including radio frequencies, latitude and longitude positioning, elevation, runways (with lengths and surface types), and ILS frequencies, if applicable.*

The *Edit* screen allows you to add and set waypoints, set cruising altitude (which Air Traffic Control uses as its clearance altitude), and check your navlog, which is automatically uploaded into your aircraft's *kneeboard* upon flight. The navlog displays important navigational data and waypoints, and estimates fuel consumption and flying time.

The Learning Center includes detailed instruction on using the Flight Planner and editing your flight plan. Open the Learning Center and click on the "Flight Planner" section. You'll also find useful information about editing your flight plans in the Learning Center, which includes a step-by-step explanation of each line in the .PLN file. By opening and editing the *saved* flight plan configuration files (.PLN) in your *My Documents/Flight Simulator Files* directory, you can make direct changes to your flight plan.

Once you've created a flight plan and are ready to get in the air, choose *Yes* when asked if you want to move your aircraft to the departure airport. (Otherwise, save the flight plan for later.) Choose *Fly Now!* and you're ready to simulate your flight.

On the Taxiway

To *taxi* is simply to move an aircraft under its own power while on the ground. In *Flight Simulator 2004,* you'll taxi an aircraft from its parked location (or from an airport gate if you're flying a passenger airliner) to the taxiway. Navigating the taxiway should be done at a "brisk walking pace" in smaller aircraft, and generally at 10–30 knots in a heavy commercial airliner.

Tip Flight Simulator 2004 *has enhanced the "scenery" with new taxiway and runway signs. Use the signs to locate and maneuver to the correct taxiways and runways assigned by Air Traffic Control. If you have trouble reading the signs, press W to remove the cockpit panel. Alternatively, you can use the* top-down view *(Ctrl+S) to find the correct runway. Also, in the ATC window, select "Progressive Taxi," which will paint a magenta line on the pavement to guide you to the runway.*

When parked at a controlled airport in a spot or at a gate, contact airport *clearance* using your *ATC* (Air Traffic Control) window (~ key). You need only request clearance if it's an IFR flight and you must have filed an IFR flight plan in order to receive clearance. You may receive an initial altitude from ATC, which you can enter into your aircraft's autopilot, if applicable.

Now (before you've moved the aircraft from its parked location) contact the airport's *ground control* and request permission to taxi. You'll receive taxi instructions directing you to a particular runway. For tips on maneuvering specific types of aircraft along the taxiway, use the quick-reference taxi tips immediately following. *Flight Simulator*'s aircraft are divided into four types: *modern, heavy, taildragger,* and *helicopter.*

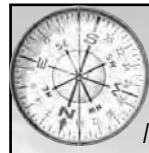
- **Private Modern Aircraft:** In planes like the Cessna, Beechcraft, Learjet, and Mooney, increase the throttle slightly to begin moving, and keep the power near or at *idle* once you're rolling. Use rudder control (twist your joystick or use rudder pedals if you have them) for directional control across the taxiway and to the runway.
- **The Heavies:** Don't use reverse thrust to back out of a gate in a Boeing 737, 747, or 777. Use the *pushback* feature: Press Shift + P to activate pushback, then use the number 1 key for *tail-left* and the 2 key for *tail-right* as needed to move onto the taxiway. Press Shift + P again to stop. When you're ready to move forward, increase the throttle slightly to begin rolling. When you start to taxi, reduce the throttle to *idle.* Adjust throttle as necessary but don't exceed 20 knots. It's difficult to get moving again, so avoid stopping during turns (see Figure 5.3). Use rudder control for directional control across the taxiway and to the runway.

Figure 5.3: *Watch your speed when taxiing a* heavy. *Avoid stopping, or you'll have to increase throttle to get rolling again.*

- **Taildraggers:** A *taildragger* (and this includes most of the historical aircraft) is a plane that has its main landing gear ahead of its center of gravity, and a tail wheel or skid supporting the aft fuselage. The plane's tail appears to rest on the ground, which gives the taildragger its name. When you're on the ground, it's difficult to see over a taildragger's instrument panel. You can adjust your view to the side windows, and follow the

taxiway by keeping an eye on its edges. Or, you can maneuver in *S-turns,* using the rudder to turn slightly left and right as you taxi so that you can see forward on the taxiway through the side windows. If you still have trouble taxiing, you can press Shift + Enter to raise your eye level to see over the panel, or use the W key to remove the panel completely.

➢ **Helicopters:** A helicopter, such as *FS 2004*'s Bell JetRanger and Robinson R22, doesn't taxi in a traditional sense, but uses *hover-taxiing* to move short distances. Given typical weather conditions and operating weights, apply 70–75 percent torque (or manifold pressure in the R22) to hover-taxi.



Developer's Tip *A new feature that helps with taxiing taildraggers is "Differential Braking." If you brake while moving the rudder pedals (or twisting your joystick), the simulator will automatically brake more on the side you're turning toward, to make the turn easier…just like a pilot would do with the pedals in a real airplane.*

As you learned in the "Student Pilot" tutorials, runways are laid out like numbers on a heading indicator, or compass. The large number painted at the end of each runway indicates its heading (or very close to it). For example, runway 9 has a compass heading of 90 degrees, or an *east* direction. The far end of the same runway has the number 27 painted on it. Its heading is the exact opposite direction: due west, 270 degrees. When told to taxi to runway 9, you should taxi your aircraft to the number painted on the runway and face in the appropriate direction for takeoff. (In this example, face 90 degrees, or east, for your takeoff.)

Once on the taxiway approaching the correct runway, open the *ATC* window again and contact the airport's *tower* to request clearance for takeoff. When cleared, proceed to the next section in this guide for takeoff instructions, tips, and quick reference tables!

Off the Runway

You've received clearance from Air Traffic Control and taxied to the appropriate runway; it's time to get airborne! Lesson 5 in the Learning Center's "Student Pilot" sessions covers takeoffs, and supplies much of the basic information you'll need to lift off of the ground successfully. Practice takeoffs using this tutorial, or set up a flight using the *Create a Flight* menu in *FS 2004* to practice takeoffs with other aircraft.

Each aircraft lifts off at a different speed. (We cover takeoff speeds later in this chapter, and throughout Chapters 2 and 3, in the "Flying Tips" sections.) Takeoff procedures are generally the same, however. Align the aircraft with the runway centerline, and advance the throttle to full power. Apply gentle rudder adjustments to maintain directional control on the runway. As you approach the aircraft's takeoff speed, pull back smoothly on the controller to lift off.

An aircraft's takeoff speed is also known as the *VR*. *VR* is one of the aircraft's *v-speed* indicators—representing *rotation* speed. It's the speed at which the pilot raises the aircraft's nose to lift off the runway during takeoff. For more on v-speeds, see Chapters 2 and 3. They're also listed on your aircraft's kneeboard.

Tip *Other important takeoff v-speeds include V1 and V2.* V1 *is* takeoff decision *speed, the speed above which it may not be possible to stop the aircraft on the runway on a rejected takeoff.* V2 *is* minimum takeoff safety speed, *the minimum safe flying speed should an engine fail immediately after takeoff. These speeds are listed in the aircraft's kneeboard (F10) and in Chapters 2 and 3 of this guide.*

Run through your aircraft's pre-takeoff checklist. (Use your kneeboard (F10) or see Appendix B, "Checklists.") Certain checklist elements may arise depending on your *Realism* settings (see Figure 5.4). For example, setting the level of realism to *Hard* disables *automixture*, among other things. One of your checks on takeoff is to make sure your aircraft's mixture is set to *full rich* so the aircraft's engine receives the optimum amount of fuel. If *automixture* is toggled on, however, your aircraft will automatically be set at *full rich* for takeoff. An exception to this is high altitude airports, in which you should lean the mixture some.

Figure 5.4: *Open the kneeboard and follow the pre-takeoff checklist for your particular aircraft.*

Increasing the *Realism* settings in *Flight Simulator*'s options menu also affects other takeoff dynamics. For example, increasing the *P-Factor* setting causes propeller-driven planes to pull left when flown at high power and low speed, which occurs during takeoff. Apply *right rudder* as necessary to counter the P-factor.

Upon takeoff, raise the aircraft's nose to a point 6–10 degrees above the horizon and accelerate to your aircraft's best *angle-of-climb* speed (VX)—the speed at which the aircraft

will gain the most altitude in the least horizontal distance. Make sure you clear any obstacles, such as buildings or trees, at the end of the runway. Retract your aircraft's landing gear (G) if applicable.

The following tables reveal the optimum takeoff speeds and minimum runway lengths for historical and modern aircraft. These figures assume standard weather conditions and plane weight.

Table 5.2: Historical Aircraft—Takeoff Speeds and Minimum Runway Lengths

AIRCRAFT	TAKEOFF SPEED	MIN. RUNWAY LENGTH
Wright Flyer	23–35 mph	Flown from Launch Rail
Curtiss Jenny	Approximately 25 mph	Any FS 2004 Runway
Vickers F.B.27A Vimy	40–45 mph	2,000 Feet (Can Lift Off in 600 Feet, but Climbs Slowly)
Ryan NYP	60 mph	2,000 Feet
Fort Tri-Motor	60 mph	2,000 Feet
Lockheed Vega	75–80 mph	2,500 Feet
deHavilland DH-88 Comet	80 mph	2,500 Feet
Douglas DC-3	84 KIAS	1,600 Feet (No Flaps)
Piper Cub	35–39 mph	1,000 Feet

Table 5.3: Modern Aircraft—Takeoff Speeds and Minimum Runway Lengths

AIRCRAFT	TAKEOFF SPEED	MIN. RUNWAY LENGTH
Cessna C172SP	50–60 KIAS	960 Feet
Cessna C182S	50–60 KIAS	960 Feet
Cessna C208 Caravan Amphibian	65–70 KIAS	2,500 Feet
Cessna C208B Grand Caravan	70–75 KIAS	2,500 Feet
Beechcraft Baron 58	75–80 KIAS	2,200 Feet
Beech King Air 350	110 KIAS	4,193 Feet (Flaps Up)
Mooney M20M Bravo	60 KIAS	2,000 Feet (Flaps 10)
Extra 300S	70 KIAS	813 Feet
Learjet 45	143 KIAS	4,700 Feet (Flaps 8)
Boeing 737-400	143 KIAS	5,500 Feet (Flaps 5)
Boeing 747-400	177 KIAS	11,000 Feet (Flaps 5)
Boeing 777-300	153 KIAS	11,000 Feet (Flaps 5)

Short Fields and Crosswinds

"Commercial Pilot" Lesson 2 in the Learning Center provides in-depth coverage of short-field takeoff procedures using a Beechcraft Baron 58. Short-field takeoffs are performed on runways that are just *slightly longer* than an aircraft's minimum runway length. (Otherwise, you couldn't take off at all.) A field also can be considered *short* because of obstacles at the end of the runway. An altitude of 50 feet is usually sufficient. This means gaining speed in a shorter amount of time, or taking off in a shorter amount of time—or both.

Tip Flight Sim *enthusiast Travis Faudree has a couple of great tips about short-field takeoffs: Short fields are fun, but can be dangerous if you don't follow a few procedures. First, most aircraft will lift off earlier and at a lower speed with* one or two *notches of flaps. This provides extra lift without a whole lot of drag. Second, you should carry only the amount of fuel required for the flight. If the flight is long, you might even have to make a fuel stop.*

Here are some tips on completing a short-field takeoff.

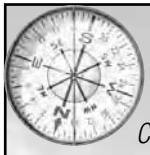
- Align the aircraft with the centerline at the base of the runway. Start as far back on the runway as possible, so you have the maximum possible distance for takeoff.
- Set flaps as recommended in your aircraft's checklist. Adding flaps can also help the aircraft lift off sooner. (See the note elsewhere in this section.)
- Hold down your aircraft's brakes (Period key) and apply full power to the aircraft (see Figure 5.5). The net effect is greater acceleration in less runway length. Release the brakes once rpm is at the maximum.

Figure 5.5: *You're on the runway ready for takeoff. To increase acceleration to takeoff speed, first advance the aircraft's throttle to* maximum *while applying the brakes.*

- Keep the aircraft straight along the runway centerline. Too much movement can detract from acceleration, speed, and momentum.
- Lift off at approximately five knots below the aircraft's VX, or best *angle-of-climb* speed.
- Raise the nose to an altitude that maintains a VX climb speed. This will likely be above 10 degrees pitch up. (For the Beechcraft Baron 58 used in the tutorial, it's 18 degrees pitch up.)
- Raise the landing gear upon establishing a positive rate of climb at VX.
- Once clear of obstacles, lower the nose and accelerate to your aircraft's VY, or best *rate-of-climb* speed (the speed at which the aircraft will gain the most altitude in the least amount of *time*).

A *crosswind* is any wind that blows across the aircraft's path. Wind will affect your aircraft's direction upon liftoff, so you must make adjustments even before takeoff to compensate for the deflection. The following list offers some tips on completing a crosswind takeoff.

- Align the aircraft with the runway centerline. Apply full aileron into the wind. If the wind blows from your left side, apply left aileron; if it's from the right, apply right aileron.
- Advance throttle to full power. Use the rudder to maintain directional control.
- As the plane accelerates, the applied aileron will become effective (The aircraft leans into the wind.) Reduce aileron slightly and keep the upwind wing (on the side from which the wind is coming) a little low.
- At the aircraft's takeoff speed, ease back on the controller and raise the nose to a climb attitude.



Tip *Many of the principles used in a crosswind takeoff apply also to a crosswind landing. See Chapter 7: "Approaches and Landings" for more discussion of short-field and crosswind landings. There's also a specific tutorial on crosswind landings in the "Commercial Pilot" lessons.*

The applied aileron will cause the aircraft to bank into the wind during liftoff. You've now established a wind-correction angle, or a *crab*. Maintain it in a straight line (along an imaginary extended centerline of the runway).

- Adjust pitch as necessary to maintain appropriate climb speed. Maintain your *crab* angle as long as you wish to maintain a heading along the extended centerline of the runway.

Takeoff Challenge

The Task: Take off from runway 4 at Tavapats Ranch Airfield (UT09) in Green River, Utah, in a Cessna C208B Grand Caravan. It's a grass strip with an approximate length of 2,500 feet. Choose the *Create a Flight* option in *Flight Simulator*'s Main Menu. Input the appropriate location and aircraft. Change the weather, however. Select *User-Defined Weather* and set the wind direction so that it's coming from 330 degrees and wind speed to 24 knots. You can change time and season to *Day* and *Spring*, respectively. Your goal is to complete a successful short-field, crosswind takeoff in the selected aircraft.

Tips: Follow the procedures outlined in the previous "Short Field and Crosswind" section for completing the task. Practice Lesson 2 of the Learning Center's "Commercial Pilot" lessons, which covers short-field takeoffs. Remove the instrument panel (press W), leaving only the vital instruments on screen, so you can see the Grand Caravan in relation to the runway. This will help you maintain directional control along the centerline and you'll also be able to see when the runway ends—to gauge your success. You can also switch to the *spot plane* view and rotate the camera around to the side of the aircraft to watch yourself lift off.

Tip *Check out the Web site http://www.dangerous-airports.com for a comprehensive listing of challenging airports, including those with short fields or at high altitudes. You can even choose from among tough landings. You can also find more by visiting other Web sites covered in Chapter 10: "Flight Simulator Community."*

Solution: Taxi to the start of the runway—to give yourself every inch possible. Apply 10–20 degrees of flaps. Activate the brakes and advance the throttle to full. When the Grand Caravan's rpm has stabilized at maximum, release the brakes to accelerate down the runway. Use rudder control to stay centered on the runway (see Figure 5.6).

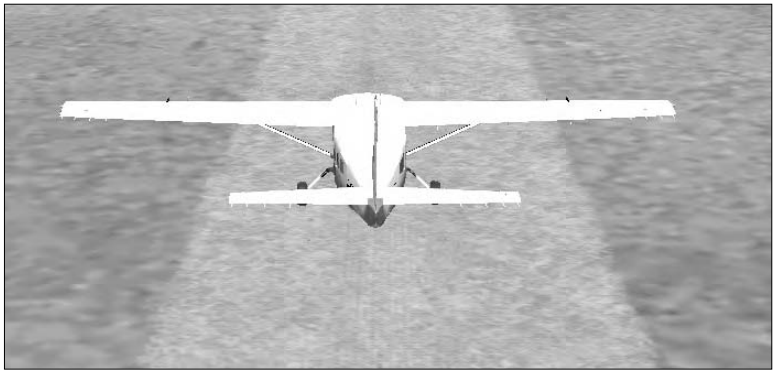


Figure 5.6: *Switch to this exterior view if you have trouble keeping the Grand Caravan centered on the runway.*

The crosswind is coming from your left, so apply full left aileron. As you accelerate, the aileron will become effective. Reduce left aileron slightly, to keep the upwind wing just a little low. (Look out the left window by adjusting your view.) The Grand Caravan's VX, or best angle-of-climb speed, is approximately 72 knots. Though short-field instructions recommend takeoff at five knots below VX, the crosswind will affect takeoff speed. Expect to take off at approximately 75 knots.

Counter the left aileron with applied right rudder, to keep from turning left. Attempt to maintain a straight 40-degree heading by following an imaginary extended runway centerline. Adjust pitch to maintain a speed of 75–80 knots until you reach an altitude of 50 feet, at which point you can reduce flaps. Nice job!

CHAPTER 6
In-Flight Navigation

An aircraft's primary purpose is to move people and cargo from point A to point B. Navigating this aerial highway can be an extremely fulfilling or highly frustrating experience, depending on your appreciation and understanding of real-world navigation techniques. From the early pilotage and dead-reckoning practices of Lindbergh and Earhart to modern instrument procedures using global positioning satellites, good pilots can almost always get to where they want to go. Why? Because they've learned how to read the aerial road signs.

This chapter not only explains how to navigate your way through the* Flight Simulator 2004 *world, it also features a number of unique challenges that are designed to hone your navigational skills and turn you into a better pilot.

VFR Navigation

VFR (Visual Flight Rules) navigation is the most loosely regulated and straightforward method of modern aerial navigation, and the one that offers the most freedom for novice and experienced pilots alike. If you simply want to take a sightseeing flight around your hometown (see Figure 6.1) or take off with no particular destination in mind, then VFR is the way to go.

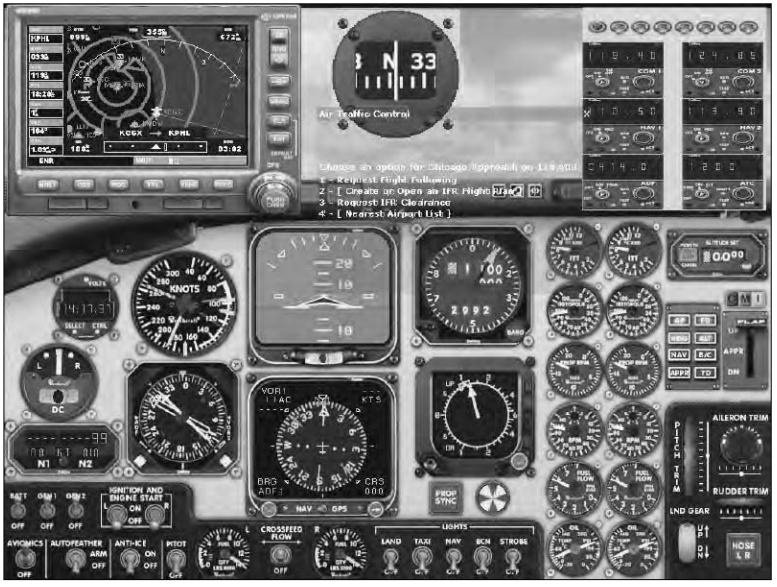


Figure 6.1: *You won't need to ask a gas station attendant for directions when you have all of these instruments pointing the way for you.*

Sometimes thought of as *fair weather flying* (as it is permitted only when weather conditions are clear enough to support visual separation and navigation), pilots using VFR flight can also fly into and out of uncontrolled airports without the need to speak to an air traffic controller. Once you are airborne under VFR flight conditions, you have a number of visual navigation methods available to you, including visible-landmark pilotage (see Figure 6.2), and dead reckoning (DR). *Flight Simulator 2004's* Learning Center provides detailed explanations of each of these methods under the "Old Fashioned Navigation" link (a subheading of the "Navigation" topic on the main page).

Note *Although it's not necessary to communicate with Air Traffic Control (ATC) under VFR conditions when flying into or out of uncontrolled airports, pilots who wish to comply with real-world airspace regulations* should *communicate with ATC when operating within or passing though Class B, C, or D airspace. Airspace definitions are explained in greater detail under the "Air Traffic Control—Understanding Airspace" subheading in the* FS 2004 *Learning Center (as well as later in this chapter).*

VFR does not restrict you to using visual navigation methods only, however. You can also polish up on your radio navigation (VOR-to-VOR) skills, or switch on one of the nifty new GPS modules in *Flight Simulator 2004* to get you pointed exactly where you need to go. In fact, many real-life pilots practice their instrument flying techniques under visual flight conditions, in preparation for their eventual Instrument Rating *checkrides. FS 2004* allows you to do the same.

For a more detailed description of VFR flight, turn to the "Old Fashioned Navigation" section of the *Flight Simulator 2004* Learning Center.

Figure 6.2: *If you can see far enough ahead and below (though not over 18,000 feet!), you can use VFR flight to get almost anywhere you want to go.*

Tip Flight Simulator's *ATC feature actually allows you to mimic the conditions under which VFR flight is no longer permitted. To test this, simply set the cloud ceiling and visibility below VFR minimums (select a cloud base of less than 1,000 feet above ground level and/or a visibility of less than 3 miles) and you will be denied takeoff clearance by ground control unless you have already filed an instrument flight plan.*

Navigating With Historic Planes

One of the most impressive new features in *Flight Simulator 2004: A Century of Flight* is its collection of nine historic aircraft dating all the way back to the original 1903 Wright Flyer. Needless to say, none of these storied planes was equipped with the advanced navigational instrumentation found on modern aircraft when they were first flown, so a different course-plotting approach should be taken with most of these lumbering old beasts (if you wish to stay true to their technological limitations, that is).

No, you won't need a sextant and a bag of bread crumbs, but a few sacrifices will certainly have to be made if you want to recreate the transatlantic flights of Alcock and Brown, or Charles Lindbergh. Here's a quick overview of the navigational challenges you will encounter with each of these planes:

Note *For more detailed information on these aircraft, read Chapter 3: "Historical Aircraft Reference," as well as Lane Wallace's descriptions in the* Century of Flight *section of* Flight Simulator 2004*'s front-end menu.*

- **Wright Flyer:** Usually, there is no reason to use the words *navigation* and *Wright Flyer* in the same sentence. Getting this plane to fly more than a couple of hundred yards is quite a feat in itself, so forget about navigation. Just try not to hurt yourself.
- **Curtiss JN-4D "Jenny":** Low and slow, the Jenny is custom-built for visible landmark pilotage (see Figure 6.3). A magnetic compass and a healthy knowledge of the surrounding countryside are all you need. (Watch out for mountains.)

Figure 6.3: *The Curtiss "Jenny" is a sweet bird to fly but, like many of* FS 2004*'s classic planes, it's a pain to navigate.*

- **Vickers F.B.27A Vimy:** With a range of just over 1,000 miles, this twin-engine WWI bomber was the first aircraft to undertake intercontinental flight. Getting this flying schooner to cover that sort of distance in *Flight Simulator 2004* is very much a "wing and a prayer" sort of exercise. With only a magnetic compass to guide you, pilotage over land and dead reckoning over water are your only options.

- **Ryan NYP *Spirit of St. Louis*:** This flying gas tank has commensurate handling characteristics. Recreating "Lucky Lindy's" transatlantic flight from New York to France won't be easy, but the plane's rotating coil earth inductor compass should keep you on course as you follow landmarks to the Nova Scotia coastline and then use dead reckoning and wind calculations (press Shift + Z to display wind speed and direction) to adjust your route over the Atlantic. Paris is only 33.5 hours away.
- **Ford Tri-Motor:** Another below-the-clouds aircraft, the Tri-Motor has enough power to keep you from running into mountains, but you'll still need to bone up on your overland pilotage and DR skills to get your passengers to their destination on time.
- **Lockheed Vega:** The *FS 2004* version of the plane used by Wiley Post and Amelia Earhart comes with a directional gyro, a VSI (Vertical Speed Indicator) gauge and a primitive ADF (Automatic Direction Finder) to help with situational awareness—but your Mark I eyeball is still your most reliable piece of equipment. This is another pilotage and DR aircraft.
- **DeHavilland DH-88 Comet:** With its variable-pitch propeller and souped-up twin engines, the Comet will get you where you want to go quickly—but don't expect to retrace the route of the 1934 London-to-Australia McRobertson Air Race without a lot of carefully plotted dead-reckoning calculations.
- **Douglas DC-3:** This aerial barge is equipped with some low-tech radio equipment that will actually allow you to perform basic ADF and VOR radio navigation (see later in this chapter) on most of your flights. You can almost smell the tubes warming up as you tune the NAV 1 radio to the nearest VOR station.
- **Piper Cub:** Back to the basics once again. You probably won't want to fly this classic light aircraft long distances anyway but, if you do, don't expect to find any complex radio or autopilot equipment under the dash. With only a magnetic compass to guide you, the Cub is a sister-under-the-skin to the Jenny.

Note *They may be old, but a lot of the historic aircraft featured in* Flight Simulator 2004: A Century of Flight *set distance and navigation records that many pilots would be hard-pressed to match today. For the ultimate in navigational challenges, try to retrace the steps of some of these pioneering aviators. (You can link directly to each of these historic flights in the "Century of Flight" section of the Learning Center.) If you can complete even one-third of Lindbergh's famous New York-to-Paris route, then you are doing exceptionally well.*

VFR Flight Challenge

This challenge will test your ability to fly a simple VFR flight with one of *Flight Simulator 2004's* classic aircraft over a short distance in sunny, clear conditions. You will be flying a Ford Tri-Motor over Northern California.

The Task: Take a direct flight from Salinas to San Jose in a Ford Tri-Motor using VFR navigation only (see Figure 6.4). Choose the *Clear Skies* weather theme from the *Weather* selection tab and set the time and season to *Day.* Distance: 41.6 nm (nautical miles). Estimated time en route: 21 minutes.

Figure 6.4: *Do you know the way to San Jose? The passengers in this Ford Tri-Motor certainly hope you do.*

Tips: Ensure that you touch down at the right airport when you arrive in San Jose. The one you want, Reid-Hillview airport, is located just to the south of the city's downtown core, and has only two short runways. If you see *three* runways, then you've likely overshot and are looking at Mineta San Jose International (KSJC). Use your in-flight map to confirm.

Solution: Take off from the active runway at Salinas Municipal (KSNS). After lifting off, turn the aircraft to the north until you see a reading of 330 on your magnetic compass, then climb to an altitude of 3,000 feet (you will have a few hills to clear). Maintain this heading and altitude until the city of San Jose pops into view, in approximately 15 or 20 minutes. Once the Reid-Hillview airport is in sight (KRHV), tune your COM 1 or COM 2 radio to the airport's ATIS (Automatic Terminal Information Service) frequency (125.20) and then contact the Reid-Hillview tower (119.80) to receive landing clearance (this is a controlled airport). Land the plane on the correct runway once you have been given permission to do so.

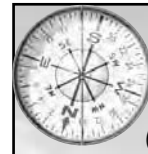
Note *For a tougher challenge, set a strong west-to-east crosswind of 20 knots on the* Weather *tab, and don't allow yourself to use the* wide cockpit *view (W key).*

IFR Navigation

Nothing can keep a good pilot down, and that statement has certainly been reinforced over the past 50 years with the development of advanced radio-based navigational instruments and ground-based transmitters. The only pilots in the real world who are permitted to get airborne nowadays when meteorological conditions have deteriorated below VFR minimums are those licensed in IFR (Instrument Flight Rules) navigation, and many of these pilots habitually use instrument flight techniques under *all* weather conditions (see Figure 6.5). It's just a more efficient way of getting around.

When you can no longer see where you're going, IFR navigation will keep you on course and allow you to land safely in even the most blinding of weather conditions. Many of the modern planes in *FS 2004* can get you *above* the clouds and bad weather, but once you're up there, how can you be expected to find any landmarks or ground cues to guide you to your destination?

You won't need to. By tuning your aircraft's onboard navigational equipment such as VOR (VHF Omnidirectional Range) radios and ADFs (Automatic Direction Finders) to the appropriate ground-based transmitters along your path, you can pinpoint your position with exceptional accuracy and fly a straight and true path all the way to your destination airport. The ILS (Instrument Landing System) receiver that's built into your NAV radio will even allow you to float your aircraft safely down to the runway under zero-visibility conditions.



Developer's Tip *Only the high-end commercial aircraft can land in zero visibility conditions (this is called Category III operations). Everyone else has to obey strict minimums as defined by the type of approach and airspeed used in the approach.*

Figure 6.5: *Most of the modern aircraft in* Flight Simulator 2004 *are IFR-ready. Are you?*

Once you're comfortable with the VFR flight procedures described at the front of this chapter, and you have also studied and understood the section on "Old-Fashioned Navigation" in the *Flight Simulator 2004* Learning Center, then it's time to move on and start earning your IFR wings. Rod Machado's "Private Pilot" and "Instrument Pilot" flying lessons in *Flight Simulator 2004* provide the best starting point toward this goal, but we'll summarize some of the key procedures for you here.

VOR Navigation

As stated earlier, VORs use very high frequency (VHF) radio transmissions to transmit a signal in all directions (omnidirectional). The ground transmitter sends a series of 360 signals—or radials—that rotate clockwise in one-degree increments. By adjusting your VOR receiver's OBS (Omni Bearing Selector) knob until the course deviation indicator (CDI) is centered, you can determine your airplane's position relative to the transmitting station by reading the radial toward which the CDI needle is pointing. The equipment is even smart enough to let you know if you are flying TO or FROM the station.

By consulting the appropriate sectional chart for the airspace in which you are flying (simply click on the map icon in *Flight Simulator 2004*), you can triangulate your exact position. Tune one of your navigation radios to a second VOR station. (Most of the modern planes in *Flight Simulator 2004* are outfitted with two NAV radios.) By extending these two radials away from the stations being tracked, your plane's current position can be plotted at the point of intersection (see Figure 6.6).

Figure 6.6: *VOR-to-VOR navigation is largely a matter of following the needles.*

Simple, right? Well, if the transmitting station is so equipped, you can also just look at your DME (distance-measuring equipment) readout to see how far away from the station you are and figure out your position that way. Either way, no IFR-licensed pilot will ever need to pull over and ask for directions as long as they are flying in a NAV radio-equipped aircraft.

"VOR Navigation," a tutorial in Rod Machado's "Private Pilot" flying lessons, is a great primer on how to intercept and track a VOR course from the comfort of a Cessna C172SP Skyhawk cockpit. Be sure to read through the accompanying text for this lesson as well, as it does a good job of breaking down and demystifying the whole VOR navigation experience.

VOR Navigation Challenge

Now that you have a better understanding of the concept behind VOR navigation, this challenge will test your ability to make a short two-leg VFR flight, using VOR stations to guide you. You will be flying a Cessna C172SP Skyhawk from Connecticut to Massachusetts.

The Task: Fly from New London, CT, to Martha's Vineyard, MA, using VOR navigation. Choose *Clear Skies* on the *Weather* selection tab, and set the time to *Night.* (Also set the wind direction in the *User-Defined Weather* menu to come FROM the east.) Distance: 69 nm. Estimated time en route: 37 minutes.

Tips: Generate a VFR flight plan, with the *FS 2004* Flight Planner, from New London (KGON) to Martha's Vineyard (KMVY), using VOR-to-VOR navigation. Click the *Find Route* button once you're ready and print out the resultant navlog for reference purposes.

Tip *Feel free to use the* Altitude Hold *and* Heading Hold *features of your autopilot in this flight to make things easier for yourself.*

Solution: Tune your NAV 1 radio to the Sandy Point/Block Island (SEY) VOR frequency (117.80) and your NAV 2 radio to the VOR frequency for Martha's Vineyard (114.50). After listening to ATIS and receiving your taxi and takeoff clearance from ATC, lift off from the active runway at New London and climb to 3,000 feet while turning the aircraft to a heading of 128. Adjust the *OBS knob* on your NAV 1 radio until the CDI needle is pointed TO the 128 radial for the Block Island VOR (the gauge's TO-FROM arrow will be pointed up). By maintaining this heading you will track the inbound 128 radial all the way to Block Island (a small island airport in the middle of Rhode Island Sound). If you find yourself off a little bit (i.e., the CDI needle isn't centered) then make a course correction *toward* the needle (until it re-centers) and then resume on a heading of 128 (see Figure 6.7). (Under crosswind conditions you might even have to adjust your heading a few degrees to the left or right of 128 to correctly track this radial.)

Figure 6.7: *Just a few more degrees to the right and we can start tracking the inbound 128 radial for this VOR.*

The needle will begin deviating from center rapidly as you pass over the Block Island station. When this happens, turn the aircraft to a new heading of 105. Adjust the *OBS knob* until the CDI needle is tracking the outbound 105 radial for the SEY VOR (the gauge's TO-FROM arrow will be pointed *down*) and follow this course out into the sound. As your aircraft tracks this outbound radial, adjust the *OBS knob* of your NAV 2 radio until the CDI needle is pointing TO the 056 radial for Martha's Vineyard (056 degrees happens to be the exact alignment of runway 6 for this airport). Continue to monitor your NAV 1 radio to ensure that you remain on the 105 outbound radial for the SEY VOR (fly *toward the needle* if you stray a little off course and then correct your heading back to 105 as it re-centers).

Once you get within 20 miles of Martha's Vineyard (the NAV 2 DME readout will let you know how far out you are), the CDI needle on NAV 2 will begin swinging toward the center of the gauge. Start turning the aircraft to the left (toward the airport) as the needle moves and try to time the turn so that you come to a heading of 056 just as it finishes centering. You are now tracking the inbound 056 radial into Martha's Vineyard and, because this VOR station is located right beside the runway, it will line you up nicely for an approach into the airport's (non-ILS) runway 6. Radio the tower for permission to land, and float that puppy right on in.

You have just completed a picture-perfect VOR-to-VOR flight. Did you happen to notice that the only time you needed to look down at the ground throughout this entire hop was during the landing phase at the end? Lindbergh would be envious.

NDB and ADF Navigation

NDBs (Non-Directional Beacons) are ground-based transmitters that broadcast a simple, non-directional AM signal that can be picked up by an aircraft's ADF (Automatic Direction Finder) antenna and receiver. Unlike its much-more informative VOR cousin, an NDB isn't really much more than a homing beacon. Tune your ADF to the appropriate frequency and an arrow will point directly at the NDB ground station. Change your magnetic heading to follow that arrow (or simply turn the aircraft until the arrow is pointing straight up) and you will have oriented yourself to fly straight toward that NDB transmitter (see Figure 6.8).

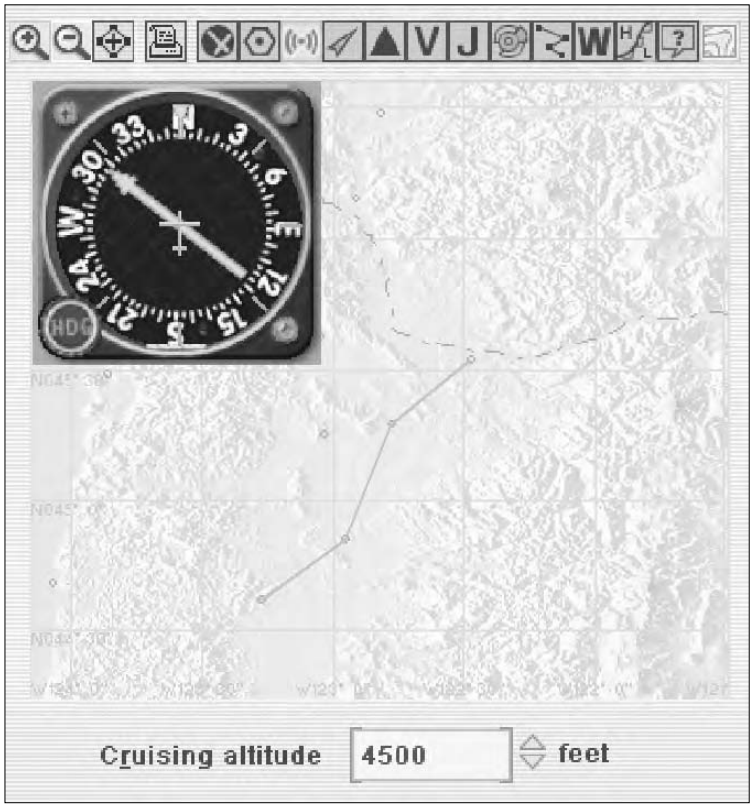
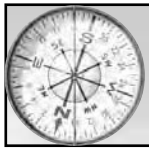


Figure 6.8: *NDB navigation is a lot like* connect-the-dots.

As simple as this seems, it's not a terribly efficient way to navigate long distances. Hopping from one NDB to the next on a flight from Seattle to San Francisco could add many unnecessary miles to the journey as you "connect the dots" all the way down the West Coast. If any significant crosswinds are present your trip could take even longer, as your aircraft flies long, curving routes to each station as it's continually being blown off course.



Note *The "Automatic Direction Finder" section (under "Navigation" in the* Flight Simulator 2004 *Learning Center) offers a lot more detailed information on the subject of ADF and NDB navigation.*

ADF-NDB Navigation Challenge

It's time to put your understanding of NDB ground transmitters and automatic direction finders to good use, in a short NDB-to-NDB flight through central Oregon.

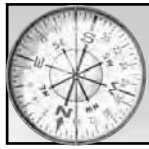
The Task: Fly from Mt. Hope (OG10) to Hillsboro (KHIO) in a Cessna Grand Caravan, using only ADF-NDB navigation (see Figure 6.9). Choose the *Clear Skies* option on the *Weather* selection tab and set the time to *Day.* Distance: Approximately 60 nm. Estimated time en route: 18 minutes.

Tips: Be sure to set full flaps during takeoff in order to clear the trees at the end of the (very) short grass runway at Mt. Hope. You can also use the *Altitude Hold* and *Heading Hold* features of your autopilot to make things easier. When you pull up the in-flight map to chart your progress, declutter the display by filtering out everything except NDBs. You will then see your path laid out in a series of small red circles.

Solution: Tune your ADF to the Turno (SL) NDB at 226.0 kHz once you've taken off from the active runway at Mt. Hope, and climb to 3,000 feet as you execute a turn to the north. Watch the arrow in your ADF display and stop your turn once it is pointed straight up. You are now flying directly toward the first NDB on the trip. Try to keep the arrow pointed straight up at all times as you fly (your heading should be around 316). Once the arrow begins to swing around on you abruptly, your plane is passing over the transmitter. Change the ADF frequency to the Minne (MM) NDB at 383.0 kHz and alter course slightly until the ADF arrow points straight up again (a course of 335 should do it). Repeat the previous procedure until the ADF needle begins swinging around hard, and then tune the ADF to 356.0 kHz to pick up the final NDB of the trip, at Abate (HI). Turn the aircraft to a heading of 339 to orient the ADF arrow straight up one last time, and start watching out the right side of the aircraft. Keep your eyes peeled until the Portland-Hillsboro airport comes into view. (It's a fairly big one, so you won't miss it.) Radio the tower for permission to land, and enter the landing pattern on their instructions.

Figure 6.9: *ADF-NDB navigation is not the most efficient way to fly this Grand Caravan through Oregon.*

Well, it wasn't a terribly efficient way to navigate but it *did* get you there. On the plus side, at least your passenger (the ADF gauge) never seemed to get tired of pointing exactly where it wanted to go. If you want to add a lot more challenge to this flight, try flying it again with a heavy crosswind. You'll understand at the end of that one why this is not the preferred method of radio navigation for pilots in the know.



Note *After you complete the GPS Navigation Challenge later in this chapter, come back and re-fly this same route from Mt. Hope to Hillsboro using GPS navigation. The difference will be quite noticeable.*

GPS Navigation

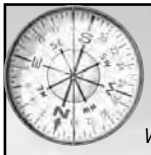
GPS—an acronym for Global Positioning System—is easily the biggest boon to civil aircraft navigation in the past decade. Employing a network of satellites to track an aircraft's position anywhere on or near the surface of the earth (and through any kind of weather), GPS navigation has made flying from point A to point B a *lot* easier. Imagine having a "magic monitor" that tracks the position of your aircraft relative to the surrounding countryside and superimposes a nice straight line underneath showing you the optimum route from your departure airport to your destination airport—all without any of the fuss or bother associated with conventional navigation aids. Although that's quite an oversimplification, it nevertheless gives you an idea how remarkably intuitive these devices can be to use.

You can also use the GPS's computer to display information on *any* airport, intersection, NDB, VOR, or airspace boundary. This can include runway lengths, ATC frequencies, navigation-aid information and airspace restrictions. You can also *proceed direct* to any of these locations, follow a VFR or IFR flight plan, or even fly instrument procedures with just a few button presses. Everything is updated in real time as your plane moves across the landscape, including relative distances, headings, and bearings.

Flight Simulator 2004 features two GPS modules, the "portable" Garmin 295 and the panel-mounted Garmin 500. Both units offer the exact same functionality, but the former has been modeled to look like its smaller, real-world counterpart. All of the modern aircraft in *Flight Simulator 2004* (with the exception of the Schweizer sailplane, Robinson helicopter, and Extra 300S) are fitted with the bigger panel-mounted 500 unit, while all of the classic planes feature the "portable" variant (see Figure 6.10).

Figure 6.10: Flight Simulator 2004 *allows you to outfit an 80-year-old plane with a modern-day GPS.*

The autopilots found in the simulation's modern planes (the Schweizer sailplane and Extra 300S aside) can even track and fly any pre-programmed GPS course for you automatically. After only one or two flights, you will soon come to appreciate why it's hard to go back to any other form of VFR or IFR navigation once you've had a taste of GPS.



Note *The "GPS" section in the* Flight Simulator 2004 *Learning Center explains exactly how all the buttons and controls for these devices work, and there is also a short video from John and Martha King showing them in use. Study this section carefully and it won't be long before you're flipping through the various buttons and page displays like a pro.*

GPS Navigation Challenge

If you've already completed the earlier VFR and IFR navigation challenges, this one should be a breeze. In this challenge, you will fly a Beechcraft King Air 350 across northern Florida, using only your aircraft's GPS unit for guidance.

The Task: Fly from Jacksonville (KJAX) to St. Petersburg (KSPG) in a Beechcraft King Air 350 using only GPS navigation (see Figure 6.11). Choose *Clear Skies* on the *Weather* selection tab and set the time to *Day.* Distance: 71.1 nm. Estimated time en route: 40 minutes.

Figure 6.11: *The quickest way from Jacksonville to St. Pete is a straight line, and a GPS will help you draw it.*

Tips: Generate a VFR flight plan with the *Flight Simulator 2004* Flight Planner between the two airports listed above (with Jacksonville as your departure airport). Choose *Direct-GPS* from the routing menu, and press *OK*. Your GPS flight plan will then be locked in.

Solution: After taking off from the active runway at Jacksonville International, toggle on your GPS unit (press the *GPS icon* on your instrument panel or hit Shift + 3 on the keyboard), and note the colored line on the GPS map display that defines your route to St. Petersburg. You can zoom out for a better look by clicking on the *Range* arrows in the top right corner of the unit, and you can also "declutter" the display in stages by repeatedly pressing the *Clear* button.

You won't need to do anything terribly fancy at this point other than to turn your plane around to intercept this colored line and follow it all the way to your destination. That's it. You can even turn on the aircraft's autopilot at this point and use the *Altitude Hold* and *Nav Hold* features to reduce your workload. Before you turn on the autopilot's *Nav Hold* button, however, be sure to switch the mode on your *Nav/GPS* toggle (the switch is located underneath the HSI (Horizontal Situation Indicator) gauge in the center of the panel) over to *GPS*. If you leave this switch set to its (default) *Nav* position, your plane will start flying toward whatever VOR transmitter you have your NAV 1 radio adjusted to, instead of following the GPS course.

Once you start getting close to St. Petersburg, 35–40 minutes later (if you hit the Caribbean, you've gone too far), radio the tower for permission to land, and bring the King Air into the landing pattern when instructed to do so.

As navigational challenges go, this simple GPS flight clearly wasn't much of a challenge at all. That's the inherent beauty of the GPS system, however: It's so simple that just about anyone can do it. If you wish to add a little variety to the proceedings, learn the button and paging commands for the *Flight Simulator 2004* GPS unit (as outlined in the Learning Center) and practice changing your route on the fly and then switching it back again. It'll give you something to do up there.

Autopilot

Of the two dozen aircraft featured in *Flight Simulator 2004: A Century of Flight,* more than half are equipped with autopilots of one type or another. As you might expect, the bigger and more expensive the aircraft, the more complex and powerful the autopilot.

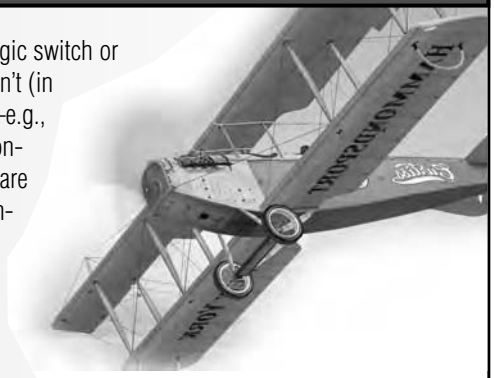
Although Microsoft chose not to retrofit any of the nine *FS 2004* historic airplanes with modern equipment, the Lockheed Vega and Douglas DC-3 *do* carry dated, perfunctory autopilots of their own that can assist in maintaining the aircraft's pitch and heading (see Figure 6.12). The Mooney and Cessna single-engine aircraft and the Beech Baron twin all feature modern autopilot units that can level the wings and maintain pitch, heading, altitude, and rate of climb/descent. These units also can track a VOR radial, GPS, or a *localizer* or *glide slope.* (The last two are horizontal and vertical signals, respectively, that can guide a plane electronically onto a runway.)

Figure 6.12: *Autopilots have come a long way from the simple heading and pitch instrument found in the Lockheed Vega.*

Step into the cockpit of a Learjet, Beechcraft King Air 350, or Boeing passenger jet and you are presented with advanced flight-control systems that consist of an autopilot, an autothrottle (jets only), and a flight director. These sophisticated bits of circuitry help you maintain airspeed and control yaw—the tendency of the plane to swing right or left on its vertical axis. These systems even help a pilot to fly the aircraft manually exactly as the autopilot would. Apart from the obvious convenience, an autopilot also helps make flying

safer, by greatly reducing pilot workload, and subsequent physical and mental fatigue, during longer flights. The "Autopilot" chapter in the Learning Center provides a detailed overview of the major key commands, buttons, and knobs that you will need to know in order to operate one of these units. Spend some time with it; it's a very worthwhile read.

Why Isn't the Autopilot Working?



Remember, *FS 2004* autopilots aren't controlled by some sort of magic switch or button. Although the Z key will toggle the autopilot on and off, it won't (in and of itself) fly the aircraft for you. You must adjust each setting —e.g., *Heading Hold, Altitude Hold,* etc.—that you wish the autopilot to control. Also, you will notice that the autopilots found in the jet aircraft are stand-alone devices with their own unique switches, knobs, and controls located along the top edge of the instrument panel. Despite their increased complexity, these advanced autopilots can actually be *easier* to use, because everything is laid out in front of you, and you don't need to pull up the radio stack every time you wish to make an adjustment.

Here are some of the common problems encountered when trying to use the autopilot.

Problem: When I turn on the autopilot with the Z key, nothing happens.

Solution: Ensure that you have given the autopilot some specific parameters (such as a numerical value for the *Altitude Hold* switch or a compass heading for the *Heading Hold* switch).

Problem: Where do I enter these figures?

Solution: Autopilot configuration and location varies from aircraft to aircraft. In the smaller planes you have to pull up the radio stack (Shift+2) to view and adjust the autopilot while the jet aircraft all boast standalone autopilots with the controls running along the top of the instrument panel.

Problem: The autopilot won't follow the GPS course that I programmed in.

Solution: Make sure that you have the *Nav Hold* switch activated and that the *Nav/GPS* switch has been turned to the *GPS* setting.

Problem: I can't get the airplane to follow the runway's glide slope when I activate the *Approach Hold* button.

Solution: You must have the ILS frequency for the runway on which you wish to land programmed in to your NAV 1 radio. Your aircraft must also be lined up fairly closely with the runway, so the ILS signal can be picked up by your NAV 1 radio. (If you're outside the width of the localizer or too far from the airport—greater than 25 nautical miles—you might not pick up the signal at all.) Your altitude must not be *higher* than the glide slope. It is accepted procedure to expect the pilot to intercept the glide slope from below. The instrument approach charts depict this for ILS approaches. If you try to intercept the glide slope from above, you will most likely not get the autopilot to lock on and get established properly. If your airspeed is too fast for the aircraft you're flying, the autopilot may not be able to maintain its lock on the localizer and glide slope.

Autopilot Navigation Challenge

You might have used the autopilot already to help you with some of this chapter's earlier challenges, but this time we're going to "let George do it"—the autopilot will perform everything except the takeoff—in a flight over Canada's British Columbia from the west coast of Vancouver Island to Vancouver International Airport.

The Task: Fly from Tofino (CYAZ) to Vancouver International Airport (CYVR) in a Learjet, using the autopilot exclusively. Choose the *Clear Skies* weather theme from the *Weather* selection tab and set the time to *Day.* (Also, set the wind direction in the *User-Defined Weather* menu to come FROM the east). Distance: 102.0 nm. Estimated time en route: 24 minutes.

Tips: Using the *Flight Simulator 2004* Flight Planner, generate a VFR flight plan between the two airports (with *Tofino* as your departure airport and *7* as your selected runway). Choose *Direct-GPS* from the routing menu and press *OK.* Your GPS flight plan will then be locked in.

Solution: You can input most of the autopilot settings on this flight before you even leave the ground. (The flight director controls for the Learjet are located along the top edge of the instrument panel.) Click on the right side of the *altitude (ALT) knob* with your mouse until a value of 6,000 is set in the counter above, and do the same with the *vertical-speed (VS) knob* until a value of +1,800 is shown. (This will tell the autopilot that you want the aircraft to climb at a rate of 1,800 feet per minute [fpm] until an altitude of 6,000 feet MSL [above mean sea level] is achieved). (MSL is also called *true altitude.*) Next, turn the *Heading (HDG) knob* to match your current runway heading (you can press Ctrl + H to do this automatically), and set the *Speed Hold Selector (SPD)* to 250. Make sure that your autopilot master switch *(AP)* is turned *off* (no green light should be visible) and that the flight director switch is turned *on* before you begin your takeoff roll. The only other autopilot buttons that should be illuminated at this point are the *HDG* and *ALT* switches.

After lifting off from the active runway at Tofino, retract your landing gear and flaps and turn the autopilot *on* (press *AP* or the Z key). Congratulations! The autopilot is now in control of your aircraft and the remainder of this flight will be hands-free all the way to touchdown in Vancouver! Immediately after you turn on the autopilot, click on the *Indicated Airspeed (IAS)* switch to arm the Learjet's autothrottle.

Note that the airplane quickly settles into a 1,800-fpm climb, and nothing you do to the throttle levers at this point has any effect on the engine power settings. That is now one less thing you need to worry about.

Toggle the *Nav/GPS* mode switch (to the left of the autopilot master switch) down to the *GPS* position and then press the *NAV* button on the autopilot. The plane will now start turning to intercept the GPS course that you previously laid in to Vancouver. Turn on your GPS (press the *GPS* icon on your instrument panel or press Shift + 3 on the keyboard) and watch

as the plane icon adjusts its heading to pick up the colored line on the GPS map display. The aircraft will eventually straighten out once it intercepts this line. Your climb to 6,000 feet is probably almost complete by now.

We eventually want to pick up the ILS glide slope for CYVR's runway 8R, so tune your NAV 1 radio to that frequency (109.5 kHz) now. (The NAV radio adjustments can be made directly to the numbers displayed in green on the middle-right portion of the instrument panel.) After the ILS frequency has been set, you will also have to adjust the *Nav Hold (CRS) selector* (to the right of the autopilot master switch) to the correct runway alignment for the ILS runway you have selected (80 degrees). The *CRS selector* knob does the same thing as the *OBS* knob in the Cessna's NAV 1 radio. You can watch the CDI arrow rotate in the Learjet's glass panel HSI display, as you change the numbers.

That done, we will now adjust the autopilot's *(HDG)* knob to a new value of 55 and then press the *HDG switch* to have the aircraft turn from its current GPS track to a new autopilot *Heading Hold* of 55 degrees. (Notice how the light on the *NAV* switch goes out once you illuminate the *HDG* switch.) The reason we are turning the plane slightly to the north is because our GPS track will not intercept the glide slope for ILS runway 8R, so we have to help it a bit. (Hey, there's not much else to do up here right now anyway.)

Remain on this heading until the plane heads out over water. Begin watching your GPS display closely at this point. When the *Bearing to CYVR* figure on the left side of the screen changes to *79*, turn the autopilot *HDG* knob to a new value of *80*. This will begin turning you toward the destination airport. You should be lined up with your target ILS runway (8R) when the turn is complete.

It's time to reduce speed. Adjust your *SPD* selector to a new value of *180* and your airspeed will begin slowing. As the aircraft gets closer to Vancouver, toggle the *Nav/GPS* switch back to *Nav* and look at the VOR 1 numbers being displayed in green at the lower left of the HSI (horizontal situation indicator) gauge (also, the green CDI arrow should be pointing straight up). If no distance and groundspeed VOR 1 figures are displayed, then you haven't picked up the ILS glide slope for runway 8R yet. They should appear once you're within 25 miles of the airport. Don't move to the next step until that happens.

Ready for a leap of faith? You are now a single button-press away from turning over the landing chores to the autopilot. As soon as you feel you're ready, click the autopilot's *Approach Hold (APR)* switch and get ready to tie your hands behind your back (well, one hand anyway). The autopilot will now adjust its course to pick up the ILS localizer for runway 8R. And as soon as it intercepts the vertical glide slope, it'll extinguish *Altitude Hold* automatically, and ride that glide slope all the way down to the runway for you (see Figure 6.13).

Figure 6.13: *The autopilot can even land your plane, if you want it to.*

At this point you might wish to consider lowering the gear, adding a few notches of flaps and reducing your airspeed by another 50 or 60 knots. Although you'll have to do the first two things manually, the last step can be accomplished by simply dialing down the value that's displayed in the *Speed Hold* indicator. Reduce this to about 120 knots and sit back while the plane floats comfortably down to the runway.

As soon as the wheels have touched down, however, you'll have to switch off the autopilot, kill the *Speed Hold (IAS) switch,* grab the controls, get on the brakes, and slow the plane to a stop. (It's actually best to turn the *IAS* switch off shortly *before* touchdown; that autothrottle can be a real pain when you need to slow down.) Apart from the takeoff and the last few seconds of the landing, however, the Learjet's autopilot just flew this entire trip for you.

Makes you feel just a little bit redundant, doesn't it?

Note *To make the landing portion of this challenge a little harder, turn it into an IFR flight, with a low (500 ft.) cloud ceiling at Vancouver. It's much easier trusting an autopilot to bring you down to a runway you can see than to a runway completely obscured by clouds.*

Air Traffic Control

Real-world aviation can be quite regulated at times, and nowhere is this more evident than in the mandated interaction that takes place between a pilot and Air Traffic Control (ATC) in controlled airspace (and occasionally even in uncontrolled airspace). The traffic cops of the sky, ground-based ATC controllers not only ensure the proper separation of all of the aircraft flying under their jurisdiction (to prevent the possibility of mid-air collisions and other catastrophic aerial mishaps), they also provide safety, weather, and navigation information, keep takeoff and landing patterns at airports running efficiently, and assist in emergency procedures.

In a typical IFR flight between controlled-airspace (towered) airports, a pilot might be in contact with eight or more different controllers throughout the course of the flight. In chronological order, these are:

- **Clearance Delivery:** This controller starts the ball rolling by authorizing your flight plan.
- **Ground Control–Taxiing to the Runway:** This controller moves you from your parking location, gate, or hangar to your assigned runway.
- **Tower–Takeoff:** Your departure tower authorizes your takeoff and provides you with an initial heading and altitude.
- **Departure Control:** After you take off, this controller directs you safely through the airspace surrounding the airport and gets you on your route.
- **Center:** Air Route Traffic Control Center (*ARTCC*, or just *Center*) controllers keep your aircraft on the correct route and at the right altitude during longer flights.
- **Approach Control:** This controller takes you through the transition from the *en route* portion of your flight to the point where you are handed off to your destination-airport tower for landing.
- **Tower–Landing:** The tower at your destination will bring you into the traffic pattern for the airport, and grant you authorization to land.
- **Ground Control–Taxiing to Parking:** This ground controller provides you with a taxiway route to your parking area, gate, or hangar.

Interactive Air Traffic Control was first incorporated into Microsoft's *Flight Simulator* series in *Flight Sim 2002*. A number of significant enhancements have been made to the *2004* version that should greatly improve your flying experience (see Figure 6.14). With these latest changes you can

- request an IFR clearance while airborne.
- request a destination change while flying under IFR.
- request altitude changes while flying under IFR.
- request full procedure approaches.
- request non-precision approaches.
- request permission to land at any runway, at airports with multiple active runways.
- request any active approach at airports with multiple approaches.
- see taxiway signs. (You'll now be able to follow taxi instructions from ATC more easily.)
- see all your ATC communication on the pop-up kneeboard. Forgot what ATC said? Just bring up the kneeboard.
- be told to "position and hold" on the runway until the aircraft in front of you for takeoff is off of the runway.
- be issued a step climb, instead of your final requested cruising altitude.

➢ see *and hear* other A.I. aircraft at non-towered airport, and make position reports to the traffic in the pattern.

Figure 6.14: T*he improved ATC affords you much more control over your flight. You can even request a different runway or IFR destination in mid-flight.*

As noted earlier in this chapter, ATC in *FS 2004* can also now detect IFR weather conditions, and will refuse permission for takeoffs and landings by VFR aircraft under those conditions.

Although ATC interaction isn't required in *Flight Simulator 2004* (you can still fly inverted loops underneath the Golden Gate Bridge all by yourself, if that's what turns your prop), this feature does greatly enhance the overall flying experience for serious sim pilots. It can get awfully lonely at 10,000 feet when there's no one to talk to, and the ATC implementa-tion in *Flight Simulator 2004* now provides you with company from engine start-up to shut-down.

Note *The on-disk Learning Center has a wealth of information on Air Traffic Control in* Flight Simulator 2004 *(a dozen articles, in fact), so feel free to study it at your convenience if you have any further questions on this feature.*

ATC Tutorial

Lesson 5 of *Flight Simulator 2004's* "Private Pilot" flying lessons offers an interactive tutorial on Air Traffic Control. This 25-minute lesson will take you through an ATC-enabled VFR flight from Renton Field, near Seattle, to Paine Field, in a Cessna 172SP Skyhawk (see Figure 6.15). Instructor Rod Machado will guide you through each step of the ATC communication process. Although it might be rather elementary for advanced pilots, the lesson is an excellent primer for ATC novices.

Figure 6.15: *Rod Machado offers an ATC primer for beginners in Lesson 5 of* Flight Simulator 2004*'s "Private Pilot Flying Lessons."*

Some points to note while taking this tutorial:

- The auto-tune feature in *Flight Simulator 2004* will automatically tune your COM 1 radio for you to the appropriate frequency as you are handed off from one controller to the next (e.g., ground control to tower). This saves you the time and trouble of looking up and manually tuning each frequency from the airport list on your in-flight map.
- Although the new taxiway signs in *Flight Simulator 2004* are a great aid in getting around the airport, you can also call up progressive taxi instructions from the *ATC* menu when talking to Ground Control, to display a visual taxiway to your runway or parking destination.
- If you miss one of Rod's instructions during the lesson, don't panic. Just press Ctrl + [and he will repeat it for you.

Emergencies

Flight Simulator 2004 allows you to simulate a variety of in-flight emergencies through its unique *Failures* dialog box. Although no one ever wishes to experience a catastrophic mechanical or instrument failure in real life, it's quite reassuring to know that you can practice many of these same mishaps from the safety of your PC desktop. (*Flight Simulator 2004* also comes with a special multiplayer mode called *Instructor's Station* that emulates the functionality of flight-training simulators costing tens of thousands of dollars. This feature allows a user on one computer to create system failures on a second user's computer.)

Programmed breakdowns and failures in *Flight Simulator 2004* can be generated in the following areas:

- Instrument failures
- Systems failures
- Radio failures
- Engine failures

The *Failures* dialog box can be found at the bottom of the *Create a Flight* option in the Main Menu (or in the *Aircraft* portion of the pull-down menu while in the simulation itself). From here you can generate single, multiple, or random failures involving key instruments or mechanical systems, and even set an arbitrary time frame within the flight when they will fail (see Figure 6.16).

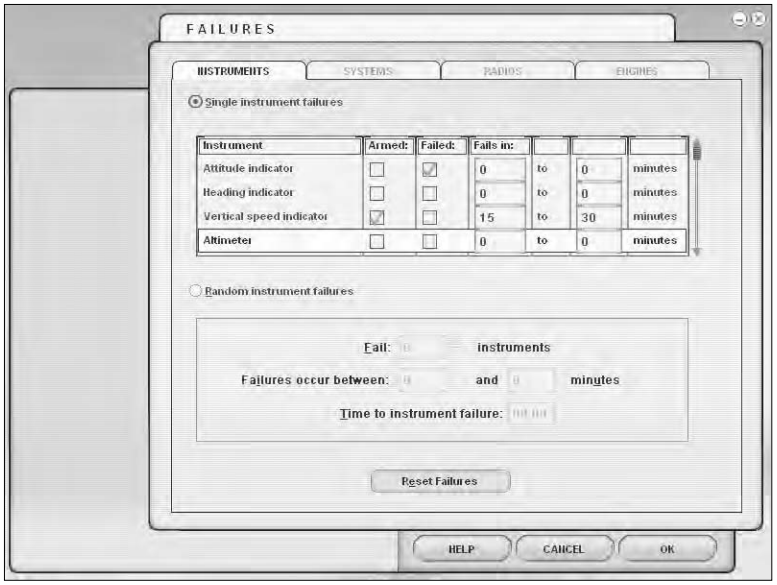


Figure 6.16: *Almost anything on your plane that can break* will, *when you tweak the appropriate* Failures *menu setting.*

The Learning Center has a detailed article on "Setting Up Failures" that can be found under the "Aircraft" subheading of the "Site Map" tab. Rod Machado's flying-lessons section also provides a two-part tutorial on engine-failure procedures, in Lesson 3 of the "Commercial Pilot" section. Although this lesson is relatively short, the *preflight briefing* text offers a wealth of information on glide speed, pattern adjustments, and related emergency procedures during a catastrophic engine failure.

Note *You cannot declare an emergency to Air Traffic Control in* Flight Simulator 2004, *and ATC won't issue* lost communications *instructions. If a communications radio fails while you're on an IFR flight plan, you won't hear any ATC instructions. Your flight plan will eventually be cancelled when you stop responding to them.*

Airspace Definitions

Almost every square inch of airspace in the civilized world is controlled, regulated, or classified by different government agencies around the globe. Although *Flight Simulator 2004* doesn't enforce adherence to these regulations, or penalize pilots who break the rules, serious sim pilots should educate themselves about these airspace definitions, particularly pilots who wish to take up real-world flying at some point.

Strictly defined, *airspace* is the part of the atmosphere that lies above the surface and is under the jurisdiction of a nation or controlling authority. In the United States, there are two categories of airspace: regulatory and nonregulatory. Within those two categories, there are *four* types of airspace: controlled, uncontrolled, special-use, and *other.* Airspace is designated as a certain type according to the density and complexity of the air traffic in the airspace, the types of operations conducted in that airspace, and other factors.

In the United States, airspace can be categorized under six classifications, as discussed immediately below.

Controlled Airspace

- **Class A:** This is airspace from 18,000 feet (5,486 meters) above mean sea level (MSL), up to and including *FL600*—Flight Level 600, or 60,000 feet (18,288 meters). Unless otherwise authorized, pilots must operate under instrument flight rules in Class A airspace.
- **Class B:** This includes controlled airspace from the surface to 10,000 feet (3,048 meters) MSL, surrounding the busiest airports. Class B airspace volumes are individually tailored, but usually include airspace within 30 miles of the primary airport. To operate in real-world Class B airspace, pilots must meet certain requirements for certification, weather conditions, and aircraft equipment, although you don't need to worry about these factors in *Flight Simulator 2004*. In the real world, you're required to contact and receive a clearance from ATC prior to entering Class B airspace. If you take off from

within Class B or Class C airspace in *FS 2004*, ATC behaves as though *Flight Following* service is automatic, meaning that ATC will handle your flight until you're out of the Class B or Class C airspace.

- **Class C:** This is airspace from the surface to 4,000 feet (1,219 meters) MSL above an airport that has an operational control tower and that is serviced by a Terminal Radar Approach Control (TRACON). Class C airspace is individually tailored for each airport, but it usually extends in a radius of five nautical miles (9.26 kilometers), rising from the surface up to 4,000 feet, and then has a shelf area extending 10 nautical miles (18.52 kilometers) from 1,200 feet (366 meters) to 4,000 feet. You're required to establish communication with ATC prior to entering Class C airspace in the real world.
- **Class D:** This class is airspace from the surface to 2,500 feet (762 meters) MSL above an airport with an operational control tower. Class D airspace is individually tailored for the airport it surrounds. You're required to establish communication with ATC prior to entering Class D airspace in the real world.
- **Class E:** This covers all *controlled* airspace that is not included in classes A, B, C, or D. You're not required to communicate with anyone when flying in Class E airspace unless the weather calls for IFR.

Uncontrolled Airspace

- **Class G:** This is uncontrolled airspace, with three different altitude levels: 1) from the surface up to and including 1,200 feet (365.76 meters) above ground level (AGL); 2) more than 1,200 feet AGL but less than 10,000 feet (3,048 meters) MSL; and 3) at or above 10,000 feet MSL, up to but not including 14,500 feet (4,420 meters) MSL. You're not required to communicate with anyone when flying in Class G airspace.

There are also a number of special-use airspace definitions such as Military Operations Areas (MOAs), Weapon Test Ranges, Prohibited Areas, Military Training Routes, and Alert Areas, but as you aren't likely to be shot down if you enter any of these restricted areas in *Flight Simulator 2004*, no one is going to stop you from flying into them (see Figure 6.17). All of these restricted zones are clearly marked on your in-flight map and GPS display with bold red borders, so don't say that you weren't warned!

Figure 6.17: Flight Simulator 2004 *might allow you to fly anywhere that you wish, but the real world has some clearly defined rules and boundaries when it comes to airspace.*

Final Navigation Challenge

It's time to put everything that you've learned about in-flight navigation to a final challenge. This flight will require your knowledge and understanding of VFR/IFR flight planning, ATC communication, autopilot operation, VOR/NDB navigation, and ILS approaches.

The Task: Fly VFR from Paine Field in Snohomish, WA (KPAE), to Friday Harbor, WA (KFHR), in a Cessna Grand Caravan. Distance: 49.6 nm. Estimated time en route: 15 minutes. Deteriorating weather conditions (and the absence of an ILS runway at KFHR) will force you to abandon your plans to land at Friday Harbor once you are within 20 miles of the airport, and you will have to divert to Bellingham International (KBLI) for an instrument landing approach in near zero-visibility conditions. You will have to generate a new IFR flight plan while airborne in order to land at KBLI.

Tips: Generate a VFR flight plan with the *FS 2004* Flight Planner between KPAE and KFHR. Choose *VOR-to-VOR* from the routing menu, 5,000 feet as your altitude, and hit *OK.* Next, use the *User-Defined* weather option to set different weather conditions at KPAE (scattered clouds, no precipitation, 30 miles visibility, and wind FROM the south for the Snohomish County weather station) and at KFHR and KBLI (overcast, heavy rain, one-sixteenth-mile visibility, and wind FROM the south for both the Friday Harbor and Bellingham weather stations). While you are altering the weather for KFHR and KBLI, click on the *Advanced Weather* page and also set the cloud base to 500 feet at both airports (see Figure 6.18). Finally, take note on your flight plan map of where Bellingham International is located, in relation to Friday Harbor. (It's 25 miles to the northeast, just below the Canadian border.)

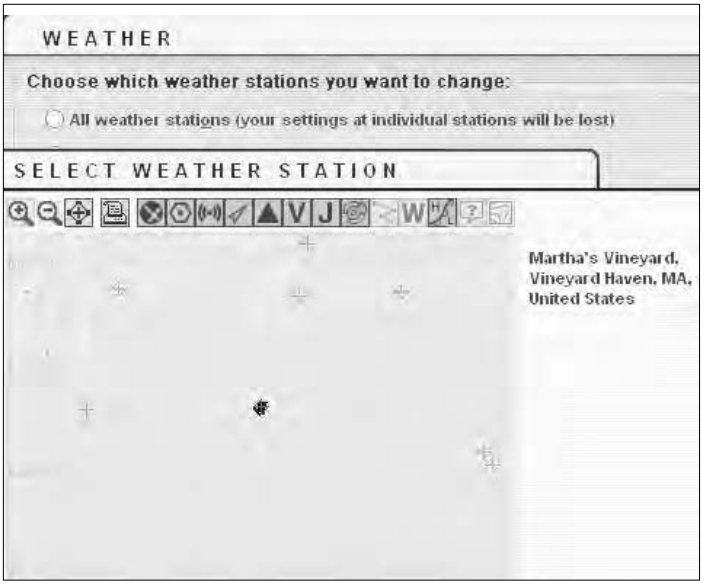


Figure 6.18: *You can fine-tune individual weather stations in* Flight Simulator 2004 *to force a VFR to IFR flight change as you move closer to your destination airport.*

Solution: First ensure that your altimeter is calibrated to the setting given to you by Paine Field ATIS so that you will have the correct altitude reading (and update this as necessary throughout the flight). After listening to ATIS and receiving taxi and takeoff clearance from Paine Field (KPAE), lift off from the active runway (16L or 16R, if you set the wind correctly during the weather set-up) and turn right to a heading of 340 as you begin your climb to 5,000 feet. (Use your autopilot's *Altitude Hold* and *Heading Hold* to make the process easier). Tune your NAV 1 radio to the Penn Cove (CVV) VOR station (117.20) and adjust the *OBS* knob on your NAV 1 radio until the CDI needle is pointed TO the 300 radial for this VOR. This is the one of the closest VOR stations to the Friday Harbor airport—albeit more than 20 miles away. Once you intercept this radial, turn to a heading of 300 to track an inbound course toward it. As you track this inbound radial you can use your time here to adjust your ADF to a frequency of 284.0 (the NDB station at Friday Harbor).

Tip *If you turn on the autopilot's* Nav Hold *switch when tracking an inbound or outbound VOR radial, it will automatically adjust your course for wind drift, saving you the trouble of constantly having to correct your heading in crosswind conditions.*

The weather should be getting pretty rough at this point. When the CDI needle on your NAV 1 display starts to swing around rapidly, you are flying directly over the Penn Cove VOR. (You can confirm this by pulling up your in-flight map.) Turn the aircraft slightly to the right until the ADF needle points straight up to indicate that you are flying toward the Friday Harbor NDB (which is conveniently located directly beside the airport). At this point you can open up your *ATC* window and select *option 2* (for airport list). Continue tapping the *9* key (for airports further away) until Friday Harbor (KFHR) appears. Once you select it

you will be shown an option to tune KFHR ATIS at 134.15. The resulting ATIS report will inform you of the airport's zero visibility, which will make landing impossible, in the absence of an ILS-compatible runway.

You will now have to open an IFR flight plan "on the fly," and divert to another airport for landing. (And the closest major airport with an ILS-equipped runway is Bellingham International.) After you are done with the ATIS report for KFHR, continue hitting the *back* option on the *ATC* screen until you have returned to the page that gives you the option to *Tune Whitbey Approach on 118.200.* After tuning to this frequency, your next option should be *Create or Open an IFR Flight Plan.* At this point, the simulation will pause as you are taken to the *Flight Planner* window. Generate an IFR VOR-to-VOR flight plan between KPAE (your original departure airport) and KBLI (Bellingham International). You will be asked to save the flight plan to disk and, after doing so, you will then be asked if you wish to move your aircraft to the departure airport listed in the flight plan. Answer *NO* to this, and you will be returned to the cockpit exactly where you left off.

At this point, you will see a new option in your *ATC* window that says *Request IFR Clearance.* Select this option and Whitbey Approach will clear you to Bellingham Airport as filed for an ILS approach to runway 16 (again, this is assuming that you correctly entered a wind direction from the *south* in your weather set-up). Once this is granted, you will be *vectored* to a new heading (assigned to a new vector, or heading) and altitude by Whitbey Approach. Follow these instructions as they come in (you can make adjustments to your autopilot's *Altitude Hold* and *Heading Hold* features to make the process much easier).

While you are being vectored toward KBLI (and handed off from one ground controller to another), you can adjust your NAV 1 radio and *OBS* knob to the airport's runway 16 ILS frequency (108.50) and heading (160) in preparation for your eventual landing. Continue to follow all of the headings and instructions given to you by ATC until you are eventually told by Bellingham Tower to intercept the localizer for ILS runway 16 and given authorization to land. Once the NAV 1 CDI needle begins to center on the HSI gauge, you can hit the *Approach Hold (APR) button* on your autopilot and let "George" bring you all the way down the glide slope to land on runway 16. (If you wish to fly this part manually, flip ahead to Chapter 7 for instructions on how to fly an ILS approach.) Be sure to adjust your airspeed as you descend on the glide slope, so as not to come in too "hot." (The landing approach speed with flaps up for the Cessna Grand Caravan is between 100 and 115 knots.)

Figure 6.19: *Sometimes you just have to park it and wait for the weather to turn.*

Welcome to Bellingham! Follow ground control's instructions to taxi off the runway to your parking spot and prepare to break out the umbrellas (see Figure 6.19). It looks like you're gonna be here awhile!

CHAPTER 7
Approaches and Landings

Landing is probably the most difficult aspect of flying an airplane in the real world, and the same certainly is true for* Flight Simulator *pilots. Dropping a substantial hunk of airplane (even a relatively light aircraft like the 2,500 lb Cessna Skyhawk) down onto a narrow landing strip from thousands of feet up in the air can be daunting enough on a bright, sunny day. Now make it a night landing, in deteriorating weather conditions, with uncooperative crosswinds, and you have a host of new "pucker factors."

This chapter will discuss a variety of approaches and landings in all types of conditions, and we'll also offer some unique challenges to test your understanding of the principles and procedures involved.

Approaches and Landings: Historic vs. Modern Planes

Flight Simulator 2004: A Century of Flight permits users to compare for themselves the flight characteristics of nine early airplanes (all built before WWII) against those of twelve modern planes. (A modern sailplane and two helicopters also are available.)

Aside from their general disparities in performance and technology, perhaps the most significant difference between the old and new planes is in their approach and landing capabilities. For instance, apart from the Douglas DC-3, which has a VOR radio, and the Vega and Comet, none of the older planes is capable of an IFR (Instrument Flight Rules) approach.

(The portable Garmin GPS—Global Positioning System—that's fitted to most of these old planes in *FS 2004* does allow you to cheat, but if Amelia and Charles Lindbergh were able to land without satellite assistance, there's no reason why you can't, as well.)

Perfect your approaches and landings (if you plan on spending much time behind the controls of these mature aircraft). And that's not all: With the exception of the Wright Flyer all of the historic airplanes in *FS 2004* are taildraggers. This configuration (in which the plane has a tail wheel, or a skid that drags on the ground) not only makes forward visibility on takeoffs more difficult, it can make landings downright diabolical (see Figure 7.1.) With some of the aircraft, you might even have to side-slip—or crab the plane to one side—dramatically on final approach just so you can see around that enormous engine cowling and get a visual fix on the runway.

Note *When it comes to landing, there is not much difference between IFR and VFR. The difference is all about getting there.*

If you wish to remain faithful to the times in which these aircraft originally flew, you will need to develop proficiency with landing procedures under varying conditions. If the weather gets too bad, however, it's best to just leave them in their hangars.

Figure 7.1: *Forward visibility during approaches can be a real problem in aircraft like the deHavilland Comet.*

Note *Read the "Taildraggers" section in the* Flight Simulator 2004 *Learning Center for more information on landing techniques with the simulation's historic aircraft.*

VFR Approaches and Landings

A VFR landing approach is the most straightforward way to get your plane on the ground. You see the airport, you enter the landing pattern for the airport, and you land at the airport. It's much like driving a car: If you can see it, you can park it.

Even in perfect VFR conditions, however, pilots must clearly announce their intentions and follow a predictable path when bringing their aircraft down to terra firma. Mid-air collisions are simply not an option. A number of factors are at play here—including the size and type of airport that you are flying into, and the Air Traffic Control (ATC) or other landing procedures associated with it (see Figure 7.2). These factors determine whether you should fly a direct route in to the active runway (a "straight-in"), circle the airport in a standard traffic pattern before turning for the final approach, or allow an ATC controller to vector you in. Controlled airports will generally provide you with all the instructions that you need, over the appropriate COM frequency, while uncontrolled (non-towered) airports usually employ standard left-hand traffic pattern approaches (although right-hand approaches are sometimes used when terrain-avoidance or noise laws come into play).

Figure 7.2: *Anyone can get it in the air, but can you get it* down*?*

Once you are on final VFR approach to your destination airport's active runway, there might be some visual aids to help you with the landing. Visual Approach Slope Indicator (VASI) lights are commonly placed alongside runways to give pilots a visual cue as to whether they are above or below the glide slope for the runway in question. Whether you use the old-fashioned "eyes-on-runway" approach or VASI lights to get you down, however, a VFR landing remains a purely visual exercise that can be done only when weather conditions and visibility permit.

Note *For more information on airport traffic patterns, refer to the briefing text for Lesson 4 ("The Traffic Pattern") in the Learning Center's "Private Pilot" flying lessons. For more information on VASI light systems, refer to the briefing text for Lesson 6 ("Landings") in the "Student Pilot" flying lessons.*

VFR Approach and Landing Challenge

This challenge is quite straightforward. You are to bring your Douglas DC-3 (see Figure 7.3) into the landing pattern of an uncontrolled airport in Alaska, while making sure you follow all of the correct procedures for a safe VFR approach and landing. This is a combined challenge that includes takeoff, navigation, approach, and landing techniques.

Figure 7.3: *When it comes to old-fashioned VFR landing approaches, the venerable and ageless DC-3 is quite possibly the world champ.*

The Task: Take off from King Salmon (PAKN) airport in Alaska in a DC-3, and fly to Dillingham (PADL). Upon arrival, enter the traffic pattern for this uncontrolled airport and land your plane safely. Choose the *Clear Skies* theme from the *Weather* selection tab and set the wind direction FROM the north. Set the time and season to *Day*. Distance: 62.4 nm. Estimated time en route: 25 minutes.

Tips: You can play with the DC-3's antique autopilot en route if you wish. After taking off from King Salmon (and once you're at 4,000 feet), set the autopilot *heading* indicator to 270 and the *pitch* reference to zero and then turn the unit on. (You can also accelerate the *simulation rate* from the *Options* pull-down menu, to reduce your flying time.)

Solution: After receiving taxi and takeoff clearances from the PAKN ground and tower controllers, take off from the active runway and turn to a heading of 270 while climbing to an altitude of 4,000 feet. Fly the "en route" portion of this 62-mile flight. Once you're within radio range, select the Dillingham airport from the *ATC* list and tune in the PADL ATIS at 125.00. After listening to ATIS, tune back to the Kenai traffic control frequency of 123.60. Select the runway on which you wish to land from the *ATC* menu options (runway 1, if you set the wind direction correctly), and then "announce" a full-stop landing from the next set of options that appear in the *ATC* window. A larger list of options will then appear that allows you to announce your position to any traffic in the area. You can radio in your position at this time if you wish, but you are still probably too far away from the airport for anyone to care all that much.

Once you have the airport in sight (it's just on the other side of a channel of water, at the base of some foothills to the west), your current course should have you approaching it at right angles to the runway. At this point, you should try to draw an imaginary rectangle around the active runway in your mind (easy to do in this case as there's only one runway) and start making plans to enter into a standard, left-hand racetrack pattern around the airport with this rectangle as your guide. As you are approaching from the east, you should adjust your heading so that you enter the traffic pattern on the crosswind leg (seeing as how you are already mostly pointed in that direction). Also begin reducing your altitude at this point, so you'll be down to approximately 1,000 feet AGL when you enter the pattern.

As soon as you're within a mile of the airport, pull up the *ATC* window and select *Announce Crosswind Leg* from the list of options. This is to let any traffic around the airport know exactly where you are so they will avoid running into you. The traffic pattern you are now in should have your plane flying at a distance between half a mile and one mile from the runway. Your heading on the crosswind leg should be 280 and your altitude should be approximately 1,000 feet MSL. Once you are half a mile to a mile west of the airport, turn to a new downwind heading of 190 and select *Announce Downwind* from the *ATC* menu. Repeat this process, after you've traveled at least one mile south of the airport (as you'll probably want a little room to line up your final approach), and then turn to a new heading of 100 to fly the base leg. In the *ATC* window, *Announce Base to Kenai Traffic*.

Once you are on the base leg you can look out your left window and eyeball the runway that you wish to land on. As soon as you feel it's time to turn (you should have a good feel for the DC-3's turning performance by now), begin turning the aircraft to the left and line your nose up with runway 1 (the true magnetic bearing for this runway is 006 degrees). Select *Announce Final* on the *ATC* menu once you're on the proper heading.

Lower your gear, apply full flaps, and bring the DC-3 in on runway 1. (There are VASI lights to the left of the runway to help you with your approach if you wish to use them. If you have questions about using VASI lights, consult in the landing tutorials in the "Flight Lessons" and documentation included with *FS 2004*.You can also refer to the table at the end of this chapter for the correct landing speeds and the minimum runway length for a Douglas DC-3.)

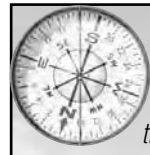
IFR Approaches and Landings

IFR landing approaches are a little more complex than their VFR counterparts, but they will allow you to land safely in all manner of inclement weather and low-visibility conditions (as well as in perfect weather).

Note *With the exception of the Douglas DC-3 (which is outfitted with a rudimentary VOR radio receiver), few of the historic aircraft in* Flight Simulator 2004 *is equipped to handle IFR approaches and landings, so you had best get used to that "new plane smell" throughout much of this chapter.*

IFR landing approaches can be broken down into two categories, precision and non-precision. Non-precision approaches (where no electronic glide slope is provided) can be further sub-categorized:

- **VOR Approach:** This instrument approach entails tuning your NAV radio(s) to one or more nearby VOR stations and then tracking predetermined radials to or from the VOR station(s) before turning for the final approach on the active runway when applicable. (For more on VOR radials, see Chapter 6: "In-Flight Navigation.")
- **NDB Approach:** This rare non-precision method utilizes non-directional beacons (NDB) and your automatic direction finder as the primary means to plot a course into an airport that employs a published NDB approach procedure.
- **GPS Approach:** This relatively painless instrument approach uses your GPS display to "draw" the approach vectors for you. All you need to do is follow the path that's laid out for you on the GPS unit's moving map.



Note *If you haven't already read through the sections related to IFR navigation in Chapter 6 of this guide, now would be a good time to do so—before proceeding with any of these IFR landing approaches.*

Precision approaches (in which a glide path reference is provided) include:

- **ILS Approach:** The common Instrument Landing System approach involves a descent to the runway guided both by horizontal and vertical electronic signals. The aircraft's NAV radio is used to intercept and track the localizer (side-to-side) and glide slope (vertical) frequencies for the active ILS runway (see Figure 7.4). ILS approaches can be further sub-categorized into Category I, II, or III approaches—with varying decision-height and visual-range minimums in effect.

- **MLS (Microwave Landing System):** This is similar to ILS, but currently limited to private companies (not applicable in *Flight Simulator*).
- **PAR (Precision Approach Radar):** In this military approach, a ground controller uses precision radar to "talk down" an approaching pilot (not applicable in *FS 2004*).

Figure 7.4: *An ILS approach is simply a matter of keeping a couple of needles on your NAV radio centered. Ham-fisted pilots need not apply.*

In layman's terms, IFR landing approaches are ultimately the safest way to return your aircraft to the ground. You will have the opportunity to prove that in the tutorials that follow (as well as in a second challenge that we've put together for you later in this chapter).

Note *The FAA is currently developing the technical specifications for a system that has proven in tests to provide precision approach guidance (including vertical guidance) using GPS as the essential element. Check out the FAA's FAQ at http://gps.faa.gov/FAQ/faq-laas.htm.*

Instrument Pilot VOR Approach Tutorial

Lesson 1 of the "Instrument Pilot" flying lessons in *Flight Simulator 2004*'s Learning Center offers a comprehensive two-part tutorial for a VOR instrument approach into an airport. The first part takes place at Paine Field, WA, while the second part has you flying into Seattle-Tacoma International. The non-precision VOR approach method is one of the most common IFR approaches in use today, but it does require the use of a published approach plate for the destination airport (see Figure 7.5).

As you will discover in the lesson, in a VOR approach you employ your NAV radio(s) to track inbound and outbound radials being transmitted by VOR stations. (You can find your exact position at the intersection of radials, if you use more than one VOR receiver.) You use the radials to line yourself up for a non-precision approach into an airport. Fixed legs of the approach are flown at specified altitudes, bearings, and distances (often dictating the use of a stopwatch) in order to get the aircraft lined up properly for final approach into the active runway. The chief advantage of a VOR approach over a visual approach is that you don't actually need to see the airport until you are very close to it (and on the correct runway heading to boot).

Be sure to print out the associated approach plates for each of these lessons prior to launching the flight—for reference purposes. You will also want to compare your flight-analysis graph with the printed version after you've landed. (The Flight Analysis option, which displays a vertical and horizontal graph of your aircraft's path, can be found under the Options pull-down menu.)

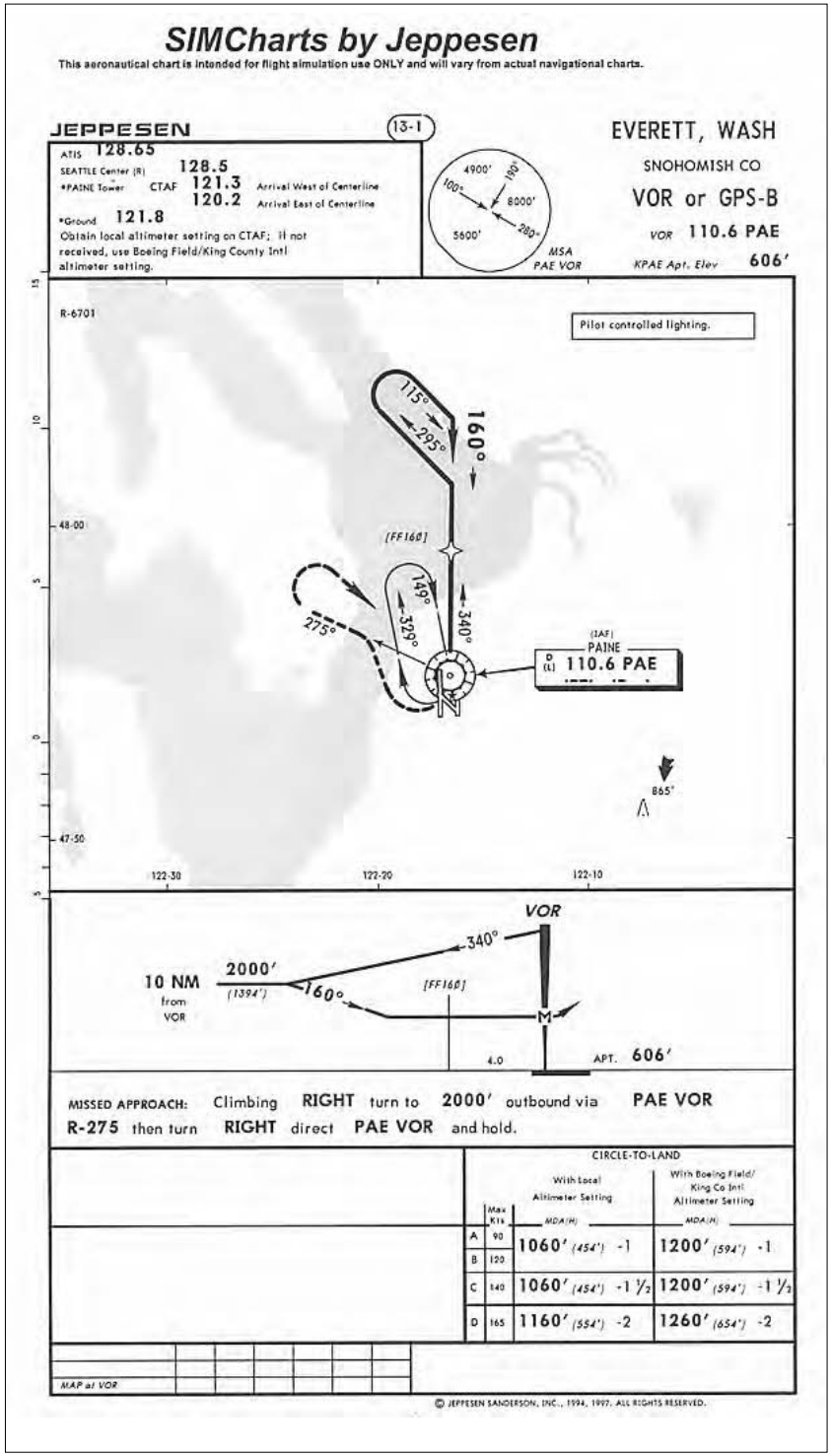


Figure 7.5: *Approach plates can seem confusing at first glance, but they pack a wealth of useful information.*

GPS Approach and Landing Challenge

This challenge will demonstrate the marvelous simplicity and adaptability of the Garmin GPS unit, as you conduct a GPS approach into an airport that supports this procedure.

The Task: Take off from Mission (KLVM) airport in Montana in a Beechcraft King Air 350, and fly to Mooney airport in Butte (KBTM). Use the *FS 2004* Flight Planner to file an IFR flight plan between the two airports, using Direct-GPS routing. Choose the *Custom Weather* option from the weather selection tab and set the wind at 8 knots FROM the south; set clouds to overcast; set precipitation to light and set visibility to 2 miles. Set the time and season to *Day*. Distance: 87.1 nm. Estimated time en route: 20 minutes.

Tips: Use your autopilot's *Heading Hold* and *Altitude Hold* features to reduce your workload en route. (You can also accelerate the simulation rate, using the pull-down menu, during portions of this flight to shorten the flying time.) For a real easy time of it, allow the autopilot to fly the GPS approach for you by turning on the *NAV Hold* button at the appropriate time. (You will still have to descend manually, however.)

Solution: After receiving IFR clearance from Great Falls Radio, take off from KLVM and climb to the heading and altitude assigned to you by the ATC controller. After a few heading changes, you will be handed off to the Salt Lake Center controller, who will inform you that you have been cleared for an ILS approach into runway 15 at KBTM. Choose the *Select Another Approach* option from the *ATC* menu and select *GPS Runway 15* from the list. When the next set of options comes up on the screen, choose *Vectors to Final Approach Course*. You will be returned to the list of options, where you must now activate your choice by selecting *Request Approach from Controller*. Once you do this you will be given clearance for a GPS approach into KBTM. (Clearance probably will be followed by a slight course-change directive.)

Note *If the altitudes employed in this challenge seem much higher than normal, it's because you are overflying the Rocky Mountains! Even at 12,000 feet you will only be a couple of thousand feet above the hard deck for much of the flight.*

At this point you can turn on your GPS (click on the panel's GPS icon or press Shift + 3), and program it for the approach that you have selected. (You filed a flight plan from KLVM to KBTM before the flight, so the airport information will already have been programmed in.) Click the PROC button to load the *Procedures* page. The *Select Approach* option should be highlighted. (If it isn't, click on one of the side arrows of the large knob down in the lower right until it is.) Press the ENT button on the right-hand side of the GPS to confirm this selection. A new page will load, giving you a selection of runway-approach options. Select *GPS 15* from this list, by clicking on one of the large knob's side arrows until it is highlighted. Press the ENT button again to confirm. The next page will ask you what GPS

method you wish to use, and give you a list of options, including specific VORs and intersections. Choose the *Vectors* option at the top of the list by pressing the ENT button. The last page will ask you whether you wish to "Load" or "Activate" the plan. Cursor down to *Activate* (with the arrow on the large knob) and press ENT one more time. Your GPS approach has now been entered.

Return to the moving map display by pressing the FPL (Flight Plan) button and you will see that some new lines have been added to the display. (Zoom in and out on the map using the RNG arrows at the top right.) Your aircraft should be following a magenta-colored line that will eventually take you to an intersection waypoint called ZIPPR, north of the Mooney airport. (Your ATC-ordered heading should put you close to this line, but not necessarily right on it.) Information on distance and bearing to the next waypoint (as well as other important numbers) are displayed along the top, and down the left side, of the screen.

After a few more hand-offs, Salt Lake Center will give you final vectors and authorization for a GPS Runway 15 approach into KBTM and instruct you to change to the advisory channel at 123.0. You are now free to maneuver the plane and fly the correct approach course as shown on your GPS display.

Tune to the KBTM Traffic channel as instructed, and select *Announce Position* from the list of menu options, to inform the local ATC of your position and your landing intentions. Watch your GPS display closely, and adjust your heading to aim for the "point" that's indicated on the magenta line (the DOVAL Intersection). Once you hit this spot you will be properly oriented to the ZIPPR waypoint (the status indicator in the lower left will change from TERM to APR to indicate a change from Terminal to Approach status). Follow the magenta line on the GPS display until you reach the ZIPPR intersection (see Figure 7.6).

Figure 7.6: *Just follow the magenta line. A GPS approach will guide you all the way to the runway. (Note the VSR descent cue on the left-hand side.)*

At this point, the VSR (Vertical Speed Requirement) readout at the lower left will begin displaying the descent rate in feet per second that you must maintain to match the correct glide slope. (Multiply this number by 60 in order to get the value in feet per minute, that you can match on your VSI [Vertical Speed Indicator] gauge.) Once the runway is in sight, lower your landing gear, apply flaps and adjust your descent rate so that the VASI approach lights seem to line up in the correct "white over red" alignment. (Refer to the table at the end of this chapter for the correct landing speed and minimum runway length for a Beechcraft King Air 350.) Land your aircraft and brake it to a stop.

Congratulations. You have just completed a tidy and efficient non-precision GPS approach into a tricky airport in poor weather. For a variation on this challenge, replay it with one of the alternate VOR or intersection-transition options on the GPS's Approach menu (e.g. CPN or EVVER, rather than Vectors).

ATC Contact for Approaches and Landings

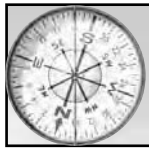
The improved ATC functionality in *Flight Simulator 2004* allows much more realistic "interaction" with controllers than in previous editions. This is particularly evident during IFR landing approaches at controlled (towered) airports, where an approach, or tower, controller will often direct you all the way down to the runway.

Below are some of the key ATC features (and changes) in *Flight Simulator 2004*, as they apply to approaches and landings.

- **VFR approach:** In the real world, controllers frequently will clear pilots for a visual approach, if conditions allow. The runway or airport environment must be in sight, or you must be able to follow other traffic to the airport, to be cleared for a visual approach. When flying a precision approach in *FS 2004*, the new *ATC* menu will include Request Visual Approach as an additional selection as soon as you're cleared for the ILS.
- **IFR approach (uncontrolled airport):** In *FS 2004*, you can create IFR flight plans into and out of uncontrolled airports. When you arrive at a non-towered airport on an IFR flight plan, approach control clears you for the approach, and instructs you to change to the advisory frequency. Once you switch to that frequency, the *ATC* menu includes two missed approach options (see Figure 7.7). You can announce a missed approach to "traffic" on the advisory frequency, or you can bypass that option and announce the missed approach directly to the approach controller. When you notify the approach controller, you're routed back onto the course to attempt the approach again. At this point, you can cancel IFR and request a VFR landing.

Figure 7.7: Flight Simulator 2004 *boasts many new ATC options, including* missed approach *declarations.*

- **ILS approach:** At airports with precision approaches, an Instrument Landing System aligned with the active runway is the default instrument approach, but you can request a different procedure from the controller. The controller will vector you onto the final approach course unless you request the full procedure. If you declare a missed approach, the approach controller will direct you back for another attempt, unless you choose a different action in the *ATC* menu.
- **Missed approach:** If you can't see the runway (or are practicing multiple approaches), you can declare a missed approach. You'll be routed back onto the approach course to attempt the approach again. You can cancel IFR and request a VFR landing, or choose another destination. The *ATC* menu will include *Declare Missed Approach* as soon as you're cleared for the approach.
- **Full-procedure approach:** You can now request permission to fly the full procedure during ILS approaches. (You will need the instrument approach plates to accomplish a full procedure.)



Note *Read the "Air Traffic Control" section of the* Flight Simulator 2004 *Learning Center for thorough information on ATC procedures during approaches and landings.*

ILS Approaches

As we said earlier, Instrument Landing System approaches are the only precision landing approaches available in *Flight Simulator 2004*. The procedure, while straightforward in theory, requires steady hands and a lot of practice to perfect. When performed in low-ceiling, low-visibility weather conditions, it also demands an enormous amount of trust in your instruments.

Flight Simulator 2004 features a pair of comprehensive ILS tutorials in the "Flying Lessons" section of the Learning Center. The "Instrument Pilot" lessons feature both an instructor-accompanied flight and a solo flight using a Cessna C172SP Skyhawk, while the "Airline Transport Pilot" section offers a similar tandem of lessons in a Boeing 737 "Heavy." (See Figure 7.8.) While these tutorials are similar in scope, they clearly demonstrate the differences between an ILS approach in a light single-engine aircraft and one in a heavy jetliner.

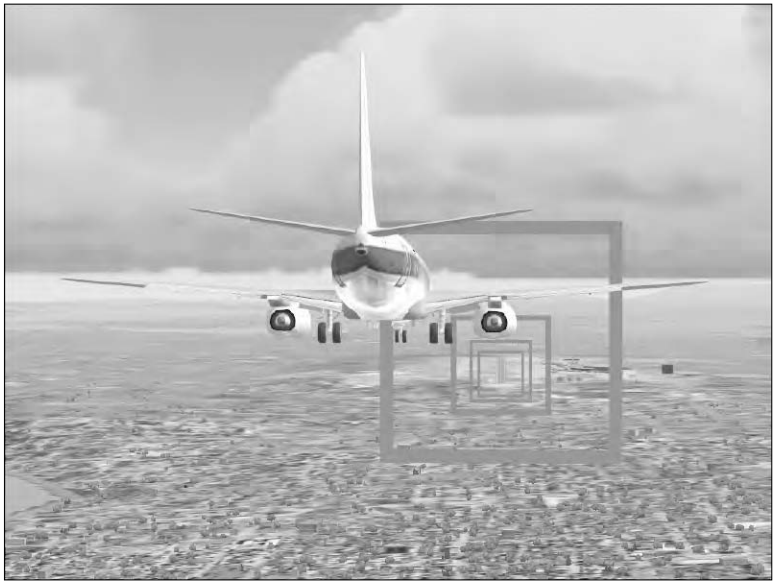


Figure 7.8: *ILS approaches are the* de facto *standard for most large jet airliners.*

With the help of these four tutorials (and their accompanying briefing texts), you should be able to perfect your *Flight Simulator* ILS approach skills in no time.

ILS Approach Challenge

This challenge will test your ability to complete a short IFR flight culminating in a precision ILS approach into an uncontrolled Massachusetts airport. You will be flying a Mooney Bravo in clear weather. (Don't get too cocky though; we've thrown in a surprise for you near the end.)

The Task: Create an IFR flight plan (Direct-GPS) from Nantucket airport in Massachusetts (KACK) to Provincetown Municipal (KPVC) in a Mooney Bravo, and execute a precision ILS approach at KPVC upon arrival. Choose the *Clear Skies* weather theme from the weather selection tab and set the wind direction FROM the east. Set the time and season to *Day*. Distance: 49.8 nm. Estimated time en route: 17 minutes.

Tips: Use your autopilot's Heading Hold and Altitude Hold en route to make the flight easier. You can also use the autopilot's Approach Hold feature when you attempt your first ILS landing at KPVC (but ultimately you should learn to fly this descent by hand).

Solution: After listening to ATIS and receiving the necessary clearances from clearance delivery, ground control, and Nantucket tower, take off from runway 6 (the active runway if you set the wind direction correctly), and climb to the heading and altitude given to you by ATC. While you have some time on your hands you can pre-tune your NAV 1 radio to the correct frequency (111.10) and OBS heading (75 degrees) for ILS runway 7 at Provincetown. (Set the NAV 2 radio to the same settings for backup.)

Continue to follow any ATC instructions as you fly north toward Provincetown. As soon as Cape Approach tells you to turn and intercept the glide slope for ILS runway 7, however, pause the simulator.

From the pull-down menu, click the *Select Aircraft* option and change your current aircraft from the standard Mooney Bravo to the special white with black IFR panel version of the plane. (Don't worry, when you return to the simulator, all of your autopilot and trim settings will be exactly as you left them.)

You are now flying almost completely blind, in a special version of the Mooney Bravo that has been equipped with a full-sized instrument panel that blocks most of your forward view (you no longer need to press Shift + 2 to bring up the radio stack, because it's built right into the panel). From this point on, you are going to bring your plane down on ILS runway 7 using only the needles on your HSI (Horizontal Situation Indicator) and NAV 2 gauges for reference (see Figure 7.9). You may wish to save this flight at this time, so you can go back and give it another crack should your first attempt fail. (Also, refer to the table at the end of this chapter for the correct landing speeds and the minimum runway length for a Mooney Bravo.)

Figure 7.9: *I'm blind! A special IFR-panel variant of the Mooney Bravo will really put your ILS landing skills to the test.*

Good luck (and have faith in those needles)!

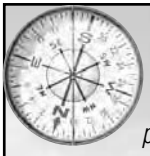
Short-Field and Crosswind Landings

Short-field approaches and landings are employed at airports that have relatively short runways, or obstacles in the final approach path, or both. Crosswind landings, on the other hand, are simply a fact of life at airports where wind direction and runway alignments don't always work out in a convenient way. (You must learn and understand the correct procedures for crosswind landings.)

Short-field approaches require intimate knowledge of your aircraft's performance and v-speed specs, especially the plane's minimum control speed and stall speeds (see Chapters 2 and 3 for more on v-speeds), as well as the maximum descent angle for that aircraft. Crosswind landings also require a clear understanding of your plane's performance specs, but just as important here is your perfection of an essential new approach technique—the side-slip, or crab.

FS 2004's Learning Center offers three dedicated tutorials on short-field and crosswind landings in its "Commercial Pilot" flying lessons section. Two of these lessons (one solo and one with an instructor) will teach you proper short-field landing techniques behind the controls of a Beechcraft Baron 58, while the third will test your handling of a crosswind approach in a Cessna C172SP Skyhawk (see Figure 7.10). The briefing text for these lessons offers a wealth of information on these subjects, which you should study thoroughly before attempting each lesson.

Figure 7.10: *If you don't already own a set of rudder pedals (or a twist-handle joystick), you may wish to acquire one before you attempt a side-slip crosswind landing.*



Tip *When performing a side-slip or crabbing crosswind landing approach, it can be quite helpful to place an axis indicator on your windshield (accessible from the* Views/View Options *pull-down menu) to see just how far away from the runway centerline your nose is pointed. Real pilots sometimes use a piece of tape for this purpose.*

Table 7.1: Historical Aircraft—Final Approach/Landing Speeds and Minimum Runway Lengths

AIRCRAFT	APPROACH/LANDING SPEED	VSO[1] (MPH)	MIN. RUNWAY LENGTH
Wright Flyer	Just above Stall (Wind-Dependent)	N/A	Several Dozen Feet
Curtiss Jenny	40 mph	45	Any *FS 2004* Runway
Vickers F.B.27A Vimy	60 mph	40	2,000 Feet
Ryan NYP	65–75 mph	71	2,000 Feet
Ford Tri-Motor	60–65 mph	58	2,000 Feet
Lockheed Vega	80–85 mph	72	2,500 Feet
deHavilland DH-88 Comet	110 mph	74	2,500 Feet
Douglas DC-3	90 KIAS	71	2,500 Feet (Full Flaps)
Piper Cub	55–60 mph	38	1,500 Feet

[1] VSO is the aircraft's stall speed in its landing configuration.

Table 7.2: Modern Aircraft—Final Approach/Landing Speeds and Minimum Runway Lengths

AIRCRAFT	APPROACH/LANDING SPEED	MIN. RUNWAY LENGTH
Cessna C172SP	65–75 KIAS (Full Flaps)	960 Feet
Cessna C182S	65–75 KIAS (Full Flaps)	960 Feet
Cessna C208 Caravan Amphibian	75–85 KIAS (Full Flaps)	2,500 Feet
Cessna C208B Grand Caravan	75–85 KIAS (Full Flaps)	2,500 Feet
Beechcraft Baron 58	100–120 KIAS (Full Flaps)	2,500 Feet
Beech King Air 350	109–120 KIAS (Full Flaps)	3,300 Feet
Mooney M20M Bravo	110 KIAS (Full Flaps)	2,500 Feet
Extra 300S	70–80 KIAS	1,798 Feet
Learjet 45	140 KIAS (Flaps 20)	3,200 Feet (Flaps 20)
Boeing 737-400[1]	135–140 KIAS (Full Flaps)	5,500 Feet
Boeing 747-400[1]	135–140 KIAS (Full Flaps)	11,000 Feet (Flaps 30)
Boeing 777-300[1]	135–140 KIAS (Full Flaps)	11,000 Feet (Flaps 30)

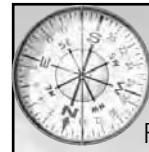
[1] Final approach speed varies with weight. These numbers are for typical operating weights.

CHAPTER 8
"So You Want To Be A..."

The sky is wide open in* Flight Simulator 2004: A Century of Flight*. With more than 24,000 airports, hundreds of thousands of miles of terrain, and two dozen modern and historical aircraft from which to choose, the flights available to you are limited only by your imagination. We hope this chapter, with its different roles for you as a pilot, and its unique (and stiff) challenges, will open your imagination to the endless possibilities within* Flight Simulator 2004*.

The three challenges in this chapter involve concepts presented throughout our earlier chapters on takeoff, navigation, and landing. We apply these concepts to the very different tasks of* bush *flying, piloting a commercial airliner, and aerobatic—or* stunt*—flying. Use these challenges to broaden your horizons! You will also find notes in this chapter from the* Flight Simulator *design team, on their favorite flights and scenery within* FS 2004*, as well as links to specific Internet resources.

Bush Pilot



Tip *You can further role-play with the historical flights offered in* FS 2004. *Choose* A Century of Flight *from the Main Menu and read Lane Wallace's fantastic articles about each historical aircraft. Through these articles you can select specific historical flights to take, using a particular aircraft. Read the* flight briefings *for information and solutions to the challenges of the flight. You can also consult Chapter 3: "Historical Aircraft Reference" and Chapter 6: "In-Flight Navigation" for additional tips on flying and navigating these planes.*

The first rule of bush flying is, there are no rules for bush flying. In a nutshell, bush flying is VFR flying ("low and slow") using uncontrolled airfields and bumpy landing strips, and passing over forests, deserts, or mountainous landscapes—essentially the remote areas of the planet. Many *Flight Simulator* "bush pilots" create their own adventures throughout Alaska and northern Canada. Here, a landing strip can be a harbor (for a seaplane), a short field, or simply a nondescript strip of land. In this section, we give you a bush-flying challenge in gorgeous eastern Alaska—during the winter.

The video, "3-point landing" located in the taildragger training article was filmed at Cabin Creek Airstrip in Idaho. The aircraft landing is a Cessna 185. You can see how short the pilot rolls out in the video—it's an excellent tutorial for proper short-field technique!

Consult Chapter 10: "Flight Simulator Community" and its compilation of Internet resources for more details on bush flying in *Flight Simulator*, including add-on aircraft and scenery to enhance your adventures. The following Internet resources also offer specific information and add-ons for bush flying.

- **Bush Flying Unlimited** (http://avsim.com/bfu/index.html): A virtual bush-flying club that offers links to add-on aircraft and scenery, as well as a forum for discussing bush flying with other simulation users.
- **Guide to Bush Flying** (http://www.fepco.com/Bush_Flying.html): A real-world guide to bush flying, written by F.E. Potts.
- **Alaskan Bush Charts** (http://avsim.com/alaska/alaska_053.htm): A virtual charter company, with links to add-on aircraft and scenery for bush flying.

Bush Pilot Challenge

The Task: Take off from Alaska's Ketchikan Harbor (5KE) in a Cessna C208 Caravan Amphibian on a southeastern course, and fly to Stewart Airfield (CZST) in British Columbia. You can use the Flight Planner to file a VFR plan using Direct-GPS routing, but the beauty of this flight is wide-open exploration. Choose *Clear Skies* for weather and set the season to *Winter* and the time to *Day*. The goal is to enjoy the wondrous fjords, mountains, and snowy terrain of the Alaskan-Canadian border before finding your destination. If necessary, use the map (press the *Map* icon on your aircraft's panel) to find Stewart Airfield and to help with your approach and landing (see Figure 8.1). Distance: 67.6 (or more) nm. Estimated time en route: Up to you!

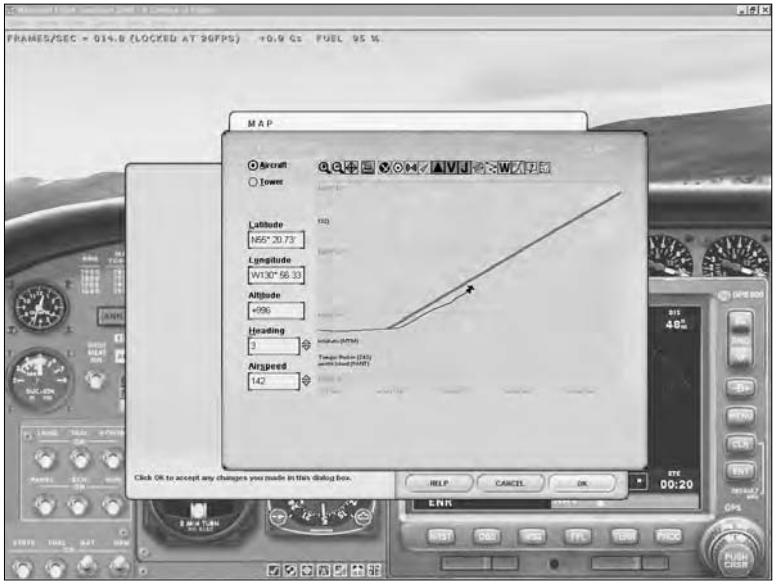
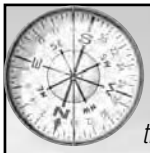


Figure 8.1: *If you need help finding the path into Stewart airfield, open your map.*



Tip *For a greater challenge, change the weather to* Winter Wonderland, *or decrease visibility a tad by using the user-created weather options. Your approach into Stewart—which is not an IFR airport—is extremely difficult under low visibility conditions; you'll have no instrument help. Remember, however, that you* are *in a Cessna C208 Caravan Amphibian, and can use the river south of Stewart as your landing strip.*

Tips: Since you used the Flight Planner and set Direct-GPS routing, you can always fall back on GPS navigation if you become lost and need to land at Stewart because of fuel concerns. Alternatively, you could *not* set the GPS until your actual flight, so you won't have that crutch. (In a pinch, you could set up a CZST waypoint on the GPS to lead you toward Stewart.) The most important tip is to simply enjoy the gorgeous Alaskan landscape with casual, low-and-slow flying! Consult Rod Machado's tutorial on "Slow Flying" in the "Student Pilot" lessons if you need further instruction on how to stay in the air at low speeds.

Solution: You'll immediately notice that 5KE, Ketchikan Harbor, is a seaplane base—so prepare for a water takeoff! As it's set up in the Flight Planner, you'll be taking off in a southeastern direction. Raise the landing gear (which you don't need, as you're on water) by pressing the G key. Set flaps to 20 (F7 until 20). Advance the throttle to takeoff power (approximately 1,900 rpm) and ease back on the controls to lift off at 65–70 KIAS.

Climb at 80–95 KIAS. At 90 KIAS, reduce flaps to 0 (F6 until 0). Maintain a steady, positive rate of climb to approximately 1,000 feet. Reduce power as desired and adjust the Cessna's nose and elevator trim to maintain the altitude. Enjoy this low-and-slow flying!

Let's head toward a nearby airfield, using VFR navigation. Upon reaching 1,500–2,000 feet (your altitude is up to you), adjust your heading to something between 145 and 150. The airfield, Annette Island (PANT), is approximately 15 nm away. You'll see a mountain on the left side of your forward view, descending to flat land that stretches out to water on the right side of your view.

Tip *You may wish to make specific graphical and scenery adjustments to enhance your "bush" experience. You're flying low, so enhance the terrain detail, and perhaps increase* autogen *density—if your computer can handle the added items. Consider toggling on* Dawn/Dusk Texture Blending *when flying at sunrise or sunset.*

You'll spot PANT and its two runways at the far end of the flatter land. Once you're over the airfield, turn northeast to a heading of 45 degrees. Maintain your desired height by adjusting your elevator trim, located on the throttle quadrant, and climb above mountains as needed. You'll clear a large mountain at 2,000 feet (make sure your altitude is over this height), then you'll spot a beautiful fjord—with rolling mountains in the distance. Adjust your heading to 25 degrees upon clearing the mountain.

Reduce altitude over the water, if you wish, and explore the fjords. You can turn north over the water, then cross the snowy, eastern mountains when you're finished. Don't go more than 30 nm (a conservative distance) north through the fjords, or you may be too far north to reach Stewart by its easiest VFR entry point—the river south of the airfield. Adjust your heading to 90 and cross the snowy mountains. Gain altitude to clear the taller mountains and reduce altitude to enjoy flying low through the valleys (see Figure 8.2).

Tip *Add challenge to this trip by performing a touch-and-go landing at Annette Island airfield. Be sure to lower your landing gear (which was raised before takeoff) and adjust flaps as necessary.*

Figure 8.2: *Although your attention should be focused on altitude, speed, and heading, don't forget to look outside and take in the gorgeous Alaskan mountains.*

If you cross the snowy peaks at their southernmost point, don't go north more than 20 nm, or you may miss the river. When you reach the river, follow it north. The river runs north to south, and perpendicular to these mountains. It's the first river after the snowy mountains you just flew over. If you don't spot a river, then you've flown too far north. Turn to a southwest heading of around 185–195 degrees and pick up the river. Swing back north and follow the river to Stewart. Reduce altitude over the water and prepare for an approach into Stewart on runway 36.

Tip *If you need help gauging your distance from Stewart, use the* ATC *window to announce your location to the uncontrolled airport. Your distance from Stewart will be broadcasted over the radio, and you can adjust altitude and speed as needed to continue the approach and landing.*

Descend to around 1,000 feet and slow the plane to 120–140 KIAS. Use elevator trim to maintain altitude. Follow the river north until you see the river's end north of you. Stewart's runway 36 is just at the end of the river. Center the plane over the river as you approach, using small adjustments to your heading as you close to within 5 nm. Lower flaps to 20 when below 150 KIAS and to *full* when below 125 KIAS. Lower your landing gear and slow to an ideal landing speed of 75–85 KIAS. Smoothly reduce altitude. As you cross the runway threshold, reduce power to *idle* and flare, keeping the plane's tail low. Apply brakes to slow the plane and prepare for your next adventure!

Other variations to this challenge could include landing on the river instead of at Stewart (Hyder is the seaplane base south of Stewart). Customize your weather to lower the cloud ceiling, so you'll have to be more careful around the taller mountains. Increase winds or decrease visibility to make the landing at Stewart tougher. If you have trouble locating Stewart and overshoot the river, activate the GPS, enter CZST as a waypoint, and follow it in to the airfield.

If you're interested in more bush flying, *Flight Simulator 2004* offers a flight series called *Alaskan Floatplane Pilot*. Choose *Select a Flight* in the Main Menu, and choose *Alaskan Floatplane Pilot* under the *Choose a Category* heading. Begin with the first flight, *Chugach Scenic Tour,* and follow the instructions in the mission briefings for each flight.

Airline Pilot

This section helps simulation users assume the role of a jet airliner pilot. Thanks to *Flight Simulator 2004*, all of us can now pilot a red-eye flight from Seattle to San Francisco in a 737-400 (see Figure 8.3). From taxi and takeoff to a landing at San Francisco International, this challenge provides a gate-to-gate walkthrough of the flight.

Figure 8.3: *Flying at 30,000 feet in a Boeing 737-400—a role* Flight Simulator *users can easily slide into.*

Virtual Airlines

Many *Flight Simulator* users have formed flying groups known as virtual airlines. The groups develop their own airlines—complete with names, logos, and specially painted aircraft—and create challenges for members. A virtual airline is a great way to become involved with the *Flight Simulator* community. For additional community sites, see Chapter 10: "Flight Simulator Community." Below are Internet resources for information on virtual airlines.

- **Virtual Airlines.Com** (http://www.planetaviation.com/virtualairlines/): This excellent site features an informative FAQ file, a list of virtual airlines, and a forum to discuss the hobby with other users. Check out the Battle of the Airlines virtual air race!
- **Airlines of the Web!** (http://www.flyaow.com/virtual.htm): On this site you'll find a compilation of virtual airline links, and more information on the hobby.

Airline Pilot Challenge

The Task: Take off from Seattle-Tacoma International (KSEA) airport in Washington in a Boeing 737-400, and fly to San Francisco International (KSFO) in California. Use the Flight Planner to file an IFR flight plan using Direct-GPS routing. Select a cruising altitude of 30,000 feet. Choose *Clear Skies* for weather and set your season to *Spring* and time to *Dawn*

(don't want to miss the fantastic sunrise over the Pacific Northwest!). The plan is to complete the flight using the autopilot in Approach Hold mode. Distance: 588.6 nm. Estimated time en route: 1 hour, 14 minutes.

Tip *To increase the challenge, alter the weather options. Select* User-Defined Weather, *click the* Customize Weather *option, and alter the weather at a specific weather station, such as the station adjacent to KSFO. You can choose to reduce visibility to just 1 mile, increase wind speed, or add precipitation. Adding these elements reveals the benefit of an instrument approach—these weather challenges shouldn't be a factor.*

Tips: Jot down KSFO's ILS frequencies by selecting the airport on your map (or during flight-planning). Select the airport from the menu—not each individual runway. Use your autopilot to make the changes in heading and altitude requested by Air Traffic Control (ATC). Consult the 747-400's v-speeds in Chapter 2: "Modern Aircraft Reference" for takeoff, ascent, cruise, descent, and landing speeds. Upon reaching cruise altitude, you can accelerate the simulation rate to shorten the flight time to your destination, but don't forget to marvel at the gorgeous landscape of Washington, Oregon, and California!

Solution: The passengers are on board and settled with seat belts fastened, and the luggage has been loaded into the cargo hold. Open the *ATC* window (~ key). Contact Seattle Clearance and request an IFR clearance. Since you have already logged the appropriate flight plan, Seattle Clearance will grant the request.

ATC will specify a *climb-out* altitude. In this example, it's 12,000 feet. Set the autopilot's ALT setting to 12,000 feet. Set the transponder code specified by ATC in your radio stack. Open the *ATC* window again and request "taxi" from Seattle Ground. Receive taxi instructions. In this example, Seattle Ground instructs you to taxi to, and hold short of, runway 16L. Begin pushback using Shift + P and then use the keys numbered 1 for *tail left* or 2 for *tail right* as needed to move onto the taxiway. Press Shift + P again to stop.

Increase power slightly to begin rolling. When you start to roll, reduce to *idle* for taxi. Use rudders for directional control and switch to *top-down view* (Ctrl + S) if you need help locating the appropriate runway. Adjust the flaps for takeoff now by setting them to *5* (F7 until *5*). Follow the taxiway to runway 16L. Contact Seattle Tower on the *ATC* window and request takeoff clearance IFR (see Figure 8.4).

Figure 8.4: *You're lined up with the runway and ready for takeoff. Request clearance from Air Traffic Control and you're set!*

Align with the runway centerline. Increase speed slowly—this allows the engines to reach uniform thrust. Once thrust is stable, increase throttle to 100 percent (be at 100 percent by 60 KIAS). Takeoff speed (VR) is approximately 143 KIAS. Smoothly pull back the controller to lift off, and maintain a 10-degree climb. Retract landing gear (G) while maintaining positive increasing rates of vertical speed and altitude. At 1,000 feet, reduce flaps to 1 (F6). Upon reaching 200 KIAS, reduce flaps to *up* (F6).

Activate the GPS unit (Shift + 3) and note your marked heading. Also note the nautical miles left in the trip, in the upper right corner, and the estimated time of flight, in the lower right corner. Toggle the switch at the right of the autopilot from *Nav* to *GPS* to switch the HSI (Horizontal Situation Indicator) over to GPS readings. Now it features *nautical miles to destination* reading and *current airspeed.*

Time to toggle the autopilot. Switch on the autopilot. Press the *ALT* button with your altitude set to 12,000. You can also turn on the autothrottle, set speed to 250 KIAS, and press the *IAS* button to set. Follow ATC handoff instructions and listen for heading instructions. You'll be told to turn to heading 160. You can make the adjustment on the autopilot under HDG. Set to 160, then press the *HDG* button to set. You can also activate the *NAV* button to maintain course on the GPS heading instead of making heading changes. Remain under 250 KIAS while under 10,000 feet. Once over 10,000 feet, adjust your airspeed to 280 KIAS.

ATC should contact you when you approach or reach 12,000 feet and assign you a new altitude (in this case, *FL220,* or a flight level of 22,000 feet). If not, you can contact them and request an altitude increase of 10,000 feet. Adjust your autopilot's altitude reading to

22,000. The same will follow upon reaching 22,000 feet. Request a change to *FL300* (30,000 feet) or follow ATC's instructions to do so. Adjust the autopilot's altitude reading to 30,000 feet.

Tip *If you're using the autopilot and need to adjust several settings while speaking with ATC, pause the simulation (using the P key) and make the necessary changes without worrying about making an error or missing any instructions. When you're finished, deactivate* pause, *and your settings will take effect.*

Use the *rule of three* to begin your descent. At 30,000 feet, when the destination airport is approximately at sea level, you should begin your descent when you're 90 nm from your destination (30 nm for every 10,000 feet). ATC may offer its own instructions as you close to within 100 nm of KSFO (see Figure 8.5). Follow their instructions or request a descent of 10,000 feet, to FL200 (20,000 feet). Set the *vertical descent rate* to –1,800 or –2,000 feet per minute. Continue down to FL150 (15,000 feet) through requests to ATC. Slow to 250 KIAS at FL1500 and adjust your descent rate to –1,500 feet per minute. Make heading adjustments as directed by ATC.

Figure 8.5: *Follow ATC instructions as you begin your initial descent into SFO at a range of approximately 90 nm.*

As you descend through 10,000 feet, make sure your speed is less than 250 KIAS. With approximately 30 nm remaining, ATC requests a descent to 4,300 feet. Slow to 200 KIAS on the autopilot and set flaps to 1. As you gathered from the map data, KFSO runways and ILS frequencies are: 28R – 111.70, 28L – 109.55, and 19L – 108.90. When you are told which runway you'll be directed to, enter the appropriate frequency into NAV 1 on your radio stack. Set it to *active.* Toggle the GPS to *NAV,* just left of the autopilot.

You should be east of KSFO at this time. As you enter KSFO airspace (at approximately 27 nm), the glide slope appears on your HSI. (Save your flight at this point. That way you

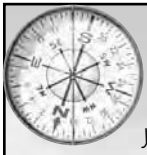
can reload in case something goes wrong, or if you want to try the approach manually or in different conditions.)

Contact Bay Approach as instructed by ATC (as you near 20 nm out) and receive final-approach instructions. Follow the requested heading (in this example, 250, which is 30 degrees off the runway heading of 280), and begin a descent at a slow rate, as instructed by ATC. Slow the aircraft to 180 KIAS and set flaps to 5.

When cleared for approach, click the *APR* (Approach Hold) button on the autopilot. The autopilot will automatically intercept the localizer and bring the plane down onto the runway (don't worry about switching off the *HDG* and *ALT* buttons, as Approach Hold will take care of these). You will have to monitor speed, flaps, and landing gear.

Tip *Challenge yourself further by bringing in the 737 manually. Follow the same speed guidelines, but don't use the Approach Hold button on the autopilot (perhaps set up a failure, so the autopilot isn't functional). Apply gentle ailerons on final approach to intercept the glide slope as you near final heading. The closer you are to destination, the more your small adjustments will affect the indicator. When the glide slope moves, apply less aileron pressure so you don't overshoot.*

As the autopilot completes its capture of the glide slope, lower the landing gear, slow to 160 KIAS, and set flaps to 15. Just before intercepting the glide slope, slow the aircraft further—to 150 KIAS—and set flaps to 25. Finally, slow to 140 with flaps 30 (landing setting). Landing speed should be 135–145 KIAS. Set autobrakes to *2,* and arm the spoilers.



Tip Flight Sim *enthusiast Geof Applegate has some great advice on setting up for a landing at an unfamiliar airport: Turn the needle on the Horizontal Situation Indicator (HSI) to coincide with the number of the runway on which you are asked to land. This way you can see the runway's alignment in relation to your present position, and the direction in which you'll be landing. For example, you're cleared to make a left downwind for runway 27. Turn the HSI needle to 27 and you'll instantly see how the runway lines up relative to your present flight path—and the direction to land. You'll easily be able to visualize the entry pattern.*

As you near the threshold, turn off the autopilot and autothrottle at around 500 feet and touch down manually. Reduce power to *idle* at 50 feet, flare slightly, and touch down on the centerline. Try to have your vertical speed indicator nearly at 0 for a gentle landing (keep those passengers happy!).

Apply *reverse thrust* to slow the plane (F2 until reverse). Return to idle speed below 60 KIAS, and contact ATC for taxiing instructions. Unload those happy passengers, refuel, and prepare the next leg of your airline flight!

Note *An airline pilot's day isn't finished after just one leg. Simulate another leg of this flight by filing a flight plan from San Francisco International (KSFO) to Los Angeles International (KLAX). It's a longer flight, at 294 nm and an estimated time of 1 hour, 33 minutes. Open the navigation map in the Flight Planner and retrieve the ILS frequencies for LAX. File the IFR flight plan with KSFO Air Traffic Control and request clearance for takeoff. After you've completed this leg, consider completing another flight plan for a flight back to Seattle-Tacoma International (KSEA).*

Aerobatic Pilot

Aerobatics is another exciting way to enjoy Microsoft's *Flight Simulator*. The nimble Extra 300S is the best airplane available in *FS 2004* for aerobatics, although other light aircraft (such as the Mooney Bravo or deHavilland Comet) can pull off many of the maneuvers outlined in the Learning Center's section on aerobatics.

A joystick (such as those suggested in Chapter 1: "Systems Check") is your best choice of controller. A flight yoke might be more realistic for normal flight, but the quick responsiveness of a joystick is better suited for aerobatics (see Figure 8.6). It's best if all necessary controls (throttle, rudder, ailerons) are available on the joystick, so you aren't hunting for keys on your keyboard during a challenging aerobatic maneuver.

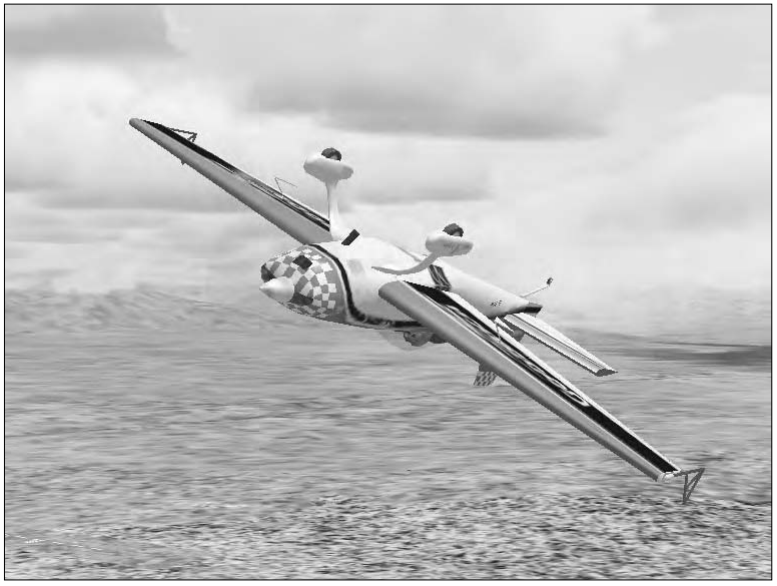


Figure 8.6: *A joystick is the best controller to use to pull off aerobatic maneuvers—like this* aileron roll *in the agile 300S.*

Aerobatic competitions take place in the aerobatic *box,* a designated segment of airspace (3,300 feet long by 3,300 feet wide by 3,500 feet tall) in which the maneuvers take place and are judged. There are four aerobatic boxes marked in *Flight Simulator 2004*. These are south of 4SD in Reno, Nevada; west of KFLD in Fond du Lac, Wisconsin; east of KEPH in Ephrata, Washington; and southwest of KAVQ in Marana, Arizona.

The Learning Center's aerobatics section provides detailed instructions on completing a variety of maneuvers, including the *aileron roll, Cuban Eight*, *split-S,* and *Immelmann.* Consult the v-speed charts in Chapter 2: "Modern Aircraft Reference" for important aerobatic speeds. Press Shift + Z twice during flight to display current G-forces, which are described in the maneuver instructions in the Learning Center.

The following are some links to Web site information on aerobatic flying.

- **Aerobatics at Simviation** (http://simviation.com/aeroworks/aerobatics/aeroinfo1.html): A great resource for *Flight Simulator* aerobatic pilots, with setup tips and numerous instructions for specific maneuvers.
- **Mudry Cap-10B** (http://library.avsim.net/sendfile.php?DLID=27639): An add-on aircraft, the Mudry Cap-10B is a French aerobatic plane.
- **The Patty Wagstaff Airshows Homepage** (http://www.pattywagstaff.com/): Here you'll find information on real-world aerobatic airshows and aircraft.

Aerobatic Pilot Challenge

The Task: Take off from runway 22 at San Rafael Airport (CA35) in San Rafael, California, in an Extra 300S and fly south to the Golden Gate Bridge, situated at the mouth of San Francisco Bay. After completing a series of aerobatic maneuvers (aileron roll, loop, Hammerhead) around and *under* the Golden Gate Bridge, return and land at San Rafael Airport. You can use the Flight Planner to file a VFR plan, or just create a new flight without the Flight Planner and set your program to take off from CA35 on runway 22. Choose *Clear Skies* for weather, and set the season to *Spring*, and the time to *Day.* Distance: Variable. Estimated time en route: As long as you're having fun!

Tips: At the *Create a Flight* screen, adjust the fuel and payload settings to approximately 1,808 lb for aerobatic flying. The Golden Gate Bridge isn't far from San Rafael, so you don't need a full tank of fuel. Maintain contact with ATC if you wish, and stay out of KSFO airspace—south of the Golden Gate Bridge. Use the map if you're lost; the bridge is at the mouth of San Francisco Bay due south of San Rafael airport. (It's also just south of Commodore Center, a seaplane harbor.) If you have trouble locating the bridge, it's at longitude N37*49.07' and latitude W122*27.06'. Consult the Learning Center for additional instruction on specific aerobatic maneuvers.

Tip *Once you're used to flying the Extra 300S and have accomplished several daring maneuvers, adjust the global* Realism *settings to* medium *or* hard, *or simply toggle on* crash detection. *That will make those aileron rolls underneath the bridge much more precarious!*

Solution: You begin on runway 22, so there's no need to taxi. (A time-saver for you, because the Extra 300S is a taildragger; navigating the taxiway would be a challenge.) You can contact ATC and announce a straight-out takeoff from runway 22. Unlock the parking brake, apply *full power* on the throttle (propeller and mixture should be set *full forward*), and lift off at 60–70 KIAS. Climb at approximately 100 KIAS to an altitude of 1,000 feet. Adjust your heading to 150 degrees—on course to the bay and the Golden Gate Bridge (rendered beautifully in *FS 2004*).

It shouldn't take long to reach the bay. You'll spot beautiful San Francisco at the left side of your view and the top of the bridge over toward the right side, just above the Marin

headlands. Clear the headlands and see the bridge stretching out ahead of you. Time to enjoy the high-powered, agile Extra 300S! Toggle on the smoke trail and have fun! Start out by descending to around 200 feet off the water and flying underneath the Golden Gate Bridge (see Figure 8.7). FYI, pilots: The *Golden Gate* is the opening into the bay, not the bridge that spans it.

Figure 8.7: *Take the 300S underneath the Golden Gate Bridge. For a greater challenge, try an aileron roll as you fly underneath!*

Tip *Toggle on the smoke trail on the Extra 300S by pressing the* I *key on the keyboard. Now you can switch to* spot plane *view (S) and watch the aircraft's flight path. See how well you are performing specific maneuvers—and show any disbelievers that you just flew under the Golden Gate Bridge!*

WARNING

One of the most important concepts to remember while trying these maneuvers is that the Extra retains its position *after it is moved by aileron and elevator pressures. For example, apply left-pressure on the control and the left wing dips. Return the controller to the center and the left wing* remains *dipped, until you move the controller to the right. Keep this in mind as you attempt maneuvers.*

Start off with a bang: Line up with the bridge and hold an altitude of 200 feet. Hold speed steady at around 140 KIAS and maneuver the 300S underneath the bridge. You can enhance the move by adding an aileron roll as you pass under the bridge. To do an aileron roll, maintain speed at 140 KIAS, pull back slightly on the controller (to 20 degrees above horizon), and move the controller smoothly all the way to one side, left or right. After completing a full roll, level the wings with the horizon.

Gain altitude and try another series of maneuvers described in the aerobatic section of the Learning Center. As you gain altitude, attempt additional aileron rolls to get a feel for how the Extra handles.

Let's try a loop. Maintain level flight at 140 KIAS and smoothly pull back on the stick at a level of 4 Gs (press Shift + Z twice to get a G-Force reading). Once you're inverted, ease off on the stick and the Extra retains its position since you aren't applying opposite pressure. Too *much* back-pressure and you could roll or stall (see Figure 8.8). As you start down, apply back-pressure again and maintain it, as the nose returns to the horizon. Use your rudder as necessary to keep the nose in place throughout the loop.

Figure 8.8: *The toughest part of the loop is at the top. Too much back-pressure on the controller and you could stall the plane or roll out of the move.*

Now try the *Hammerhead*—adjacent to the Golden Gate and with the San Francisco skyline as a backdrop. Maintain level flight at 180 KIAS and apply smooth back-pressure on the controller to a level of 6 Gs. Achieve straight vertical flight. Apply elevator pressure as needed to maintain vertical flight. As your airspeed approaches 0, push full left rudder and apply some right aileron to pivot around the wing tip. Fly straight down and apply back-pressure to return to straight and level flight. Check the Learning Center for full instruction (and notes on common errors) regarding a variety of moves.

CHAPTER 9
The Multiplayer Skies

Flight offers a feeling of freedom, but it can get lonely up there. This chapter is a thorough introduction to the enjoyment of* Flight Simulator 2004: A Century of Flight *in* Multiplayer mode. *Enjoy sightseeing or competition with other aviation enthusiasts from around the world!

"Multiplayer Setup" covers* FS 2004*'s multiplayer options— optimizing your system for Internet online play—and offers tips on joining or even hosting a multiplayer scenario. We also offer a few troubleshooting suggestions.

Once you're set for online multiplayer flying, you're ready to join a* FS 2004 *server and accompany thousands of other users enjoying the simulation as a group. In "Spreading Your Wings," we'll tell you about online* flightboards*—telling interested pilots where to find active multiplayer gaming—and about important* add-ons*, such as VATSIM and Roger Wilco, which enhance online flying. We also suggest exciting activities that make spreading your wings with other online pilots an entirely new experience.

Multiplayer Setup

This section offers instruction on optimizing your connection for the Multiplayer mode in *Flight Simulator;* briefs you on multiplayer options and their functions; and walks you through the process of creating a sample multiplayer session.

Optimizing Your Connection

Smoothness in any multiplayer game or simulation over the Internet is a function of *latency,* which is a measure of how fast your computer and online connection can communicate with other players. The lower your latency (typically given as a number in milliseconds, called a *ping*), the better your chances of a smooth *Flight Simulator* session.

On Microsoft's online service, MSN Gaming Zone (on which you can host or join *FS 2004* sessions), latency is displayed as a colored meter next to a player's name. The more green bars next to a player's name, the better the connection (thus the lower the latency). If red bars are displayed next to a player's name, avoid joining that session, as the high latency will produce a slow simulation experience. Read more about MSN Gaming Zone in the "Creating a Session" section of this chapter.

Use the following tips to decrease your connection's latency and improve your multiplayer session.

- **Close all unnecessary programs:** Shut down all unnecessary programs before launching *FS 2004,* and especially before hosting or joining a multiplayer session. It's very important to shut down any programs that use your Internet connection, such as e-mail, download, or instant-messenger programs. *FS 2004* should be the only program using your Internet connection.

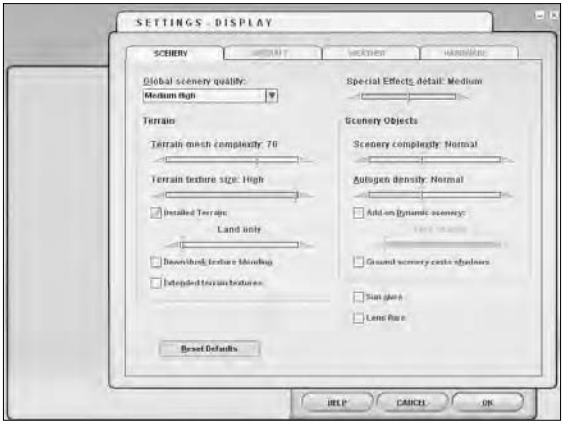


Figure 9.1: *Multiplayer sessions demand more of your computer. Adjust detail and hardware settings to compensate, and ensure a smooth flight experience.*

- **Reduce detail settings:** Even though *FS 2004* might run smoothly at particular detail settings in solo mode, it might become necessary to lower the level of detail to achieve a smooth multiplayer session (see Figure 9.1). Multiplayer sessions require more of your computer's CPU, memory, and video-card power. Lowering your detail settings can increase overall performance and help decrease latency. See Chapter 1, "Systems Checklist," for tips on *FS 2004*'s detail and hardware settings.

- **If using a 56K modem:** You can find tips on tweaking your 56K modem settings to increase performance and decrease connection latency at Tweak3D (http://www.tweak3d.net/tweak/modem/).

WARNING

Use caution when performing any of the connection tweaks mentioned at Tweak3D. We can't provide any technical support for these tweaks. Use at your own risk! Read all instructions thoroughly. If you have questions about these tweaks, post them on the Tweak3D message forum (http://bbs.pcstats.com/tweak3d/).

- **If using cable or DSL connection:** You can find tips on tweaking your cable or DSL connection settings to increase performance and decrease latency at Tweak3D (http://www.tweak3d.net/tweak/cable/).
- **Limit number of flyers:** If you're hosting a game, consider limiting the number of flyers in your session. If performance remains high, then you can add flyers. When performance begins to lower, drop the number of flyers down a notch. The more users on the host's computer, the greater the demand on the host's computer's resources. You also should limit your server to those players with a high-speed connection, and you shouldn't *host* if you're connecting via modem.
- **Increase connection speed:** The best way to decrease latency and improve *FS 2004* multiplayer performance is to increase your connection speed. If you're using a 56K modem, consider upgrading to a cable or DSL connection, if it's available in your area. Call your local cable company or check a DSL Web site such as http://www.dslreports.com for more information on the availability of broadband, high-speed connections in your zip code.

Multiplayer Options

Flight Simulator 2004: A Century of Flight offers a handful of multiplayer options to configure your specific session. Some of these can increase or decrease session performance, so experiment with these settings to ensure that you're running the smoothest session possible.

- **Display player names:** Toggle this setting on to display the names of other players in the simulation. This is particularly useful if you're flying in formation or maintaining close contact with a particular player.
- **Other players see animations on your aircraft:** Toggle this setting on, and other players who have toggled on *See animations on other players' aircraft* will see animations on your aircraft such as moving landing gear and flaps. Toggling this off can improve multiplayer performance.
- **See animations on other players' aircraft:** Toggle this on to see animations on other players' aircraft as long as those players have toggled on *Other players see animations on your aircraft*. Toggling this off can increase multiplayer performance.

➢ **Update date and time:** This synchronizes the flight's date and time with that of other players in your multiplayer session.

Creating a Session

Flight Simulator 2004 allows you to create a multiplayer session on MSN Gaming Zone (http://zone.msn.com—or just click on the *Zone* logo on the multiplayer menu) or to host a multiplayer session that other users can join via IP address, or on a direct local area network (LAN).

To find a multiplayer session on the MSN Gaming Zone, load its home page in your Web browser and enter the section designated for *FS 2004* (see Figure 9.2). From there you can chat with other users, join an existing multiplayer session, or create your own. When browsing existing games, be sure to read the game title and view the game options, so you know the particular session's requirements and settings.

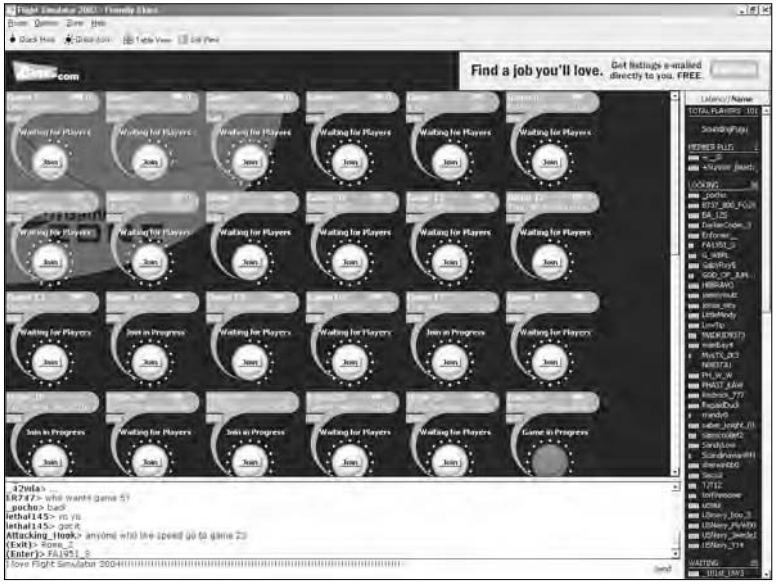


Figure 9.2: *The MSN Gaming Zone is a great place to meet and interact with fellow simulation users.*

Tip Flight Simulator 2004: A Century of Flight *multiplayer sessions can be found in the "CD-ROM Required" section of the MSN Gaming Zone. Bookmark this Web site—http://zone.msn.com/hub_cdromrequired.asp—to go directly to this particular gaming hub on the Zone.*

You can also create a session for direct IP or LAN play, straight from *FS 2004*'s *Multiplayer* menu. If you're hosting on a LAN, any player connected to the network will find your session by its name in the appropriate dialog box.

If you're hosting a direct IP game, you must provide your IP address to other users. For example, you could post your IP address on a *Flight Simulator* flightboard (more later in this chapter). These players can then enter *FS 2004*'s multiplayer section and type in your IP to join a session.

There are a couple of ways to determine your IP address if you don't know it. On Windows 9x systems, run *winipcfg* from the *Run* dialog box on your *Start* menu. Your IP address appears in the *IP Configuration* box. On Windows 2000 and XP systems, run *cmd* from the *Run* dialog box on your *Start* menu. At the command prompt, type *ipconfig* and press *Enter*. Perhaps an easier way is to load your web browser and visit the Web site http://www.whatismyip.com. Your IP address appears at the top of this web page.

Once you've hosted (arranged and posted) the session, simply use the *Create a Flight* menu to begin a flight—with your choice of departure, aircraft, time, season, and weather settings. Other players can join your session at any time and should go to the same location. Press the Enter key during flight to chat with other users in your session.

Spreading Your Wings

You've optimized your connection and have learned to host and join games, so it's time to get started with your multiplayer experience. With *Flight Simulator 2004* multiplayer, as the saying goes, the sky is the limit. *FS 2004*'s multiplayer component is as open-ended as its solo mode. You can choose to simulate any flight in any aircraft in any part of the world.

This section will help you find other users to fly with. We also discuss some important add-ons that will enhance your enjoyment of the simulation, and suggest some multiplayer activities.

Flightboards

Flight Simulator users often use *flightboards* to post their IP addresses for direct IP multiplayer sessions. They include other information about the session, including settings, location, weather, season, time, and any specific activities on the server. (For example, perhaps the session is all about historical flights on the West Coast, or is limited to bush flying.) This section provides links to several *Flight Simulator* flightboards to help get you started in *FS 2004* multiplayer sessions.

Tip Flight Simulator *Web site message forums are an excellent resource for finding active* FS 2004 *servers or finding other flyers for a multiplayer session. See Chapter 10, "*Flight Simulator *Community," for a compilation of* Flight Simulator *Web sites.*

- **Flightboard Network** (http://www.tradeip.com/sites/tradeip/): Click on the flightboard graphic to see available sessions and details such as server activity and description, as well as various settings such as host connection, add-ons, and skill level (see Figure 9.3).

Figure 9.3: *The Flightboard Network is an excellent resource for finding* Flight Simulator *multiplayer sessions.*

- **Group Flight** (http://www.flyava.org/GroupFlight/): The Group Flight home page is a meeting ground for online flyers. The *schedule* lists current and upcoming flights; a *briefings area* lists the flight's settings and everything you'll need to participate; and a *photo album* compiles screenshots from specific group flights. Group Flight is an up-to-date flightboard resource and an excellent place to start in the community. Read the *Who Are We?* section for more information, or visit the *Contact Us* page for email links to the hosts.
- **Simviation's Flightboard** (http://www.simviation.com/fsdflightboard.htm): This flightboard at Simviation.com provides a helpful frequently-asked-questions file for new users, and a tutorial on flying online using the flightboard.
- **South Africa Flightboard** (http://www.niitsa.co.za/flysa/flights.asp): Billed as South Africa's only flightboard, this well-designed Web site features unique, up-to-date sessions. The flightboard describes the flight and lists settings and requirements. Recommended for users with high-speed connections.

Add-Ons

User-created add-ons enhance everything from aircraft and scenery to navigational tools and real-voice communications. See Chapter 10, "*Flight Simulator* Community," for more on add-ons and where to find them. This section focuses on multiplayer-specific add-ons.

- **VATSIM** (http://www.vatsim.net): VATSIM, the Virtual Air Traffic Network, is the primary focus of the *Flight Simulator* multiplayer community. It's not really an add-on per se but more of a service—a place to fly. VATSIM gives its users the opportunity to assume the role of an air traffic controller or a pilot. It's a free service. All users connect to the same global network using real-time weather (see Figure 9.4). Check out the *Help* files at the VATSIM home page, and download all necessary software from VATSIM's download page (http://www.vatsim.net/downloads.html).

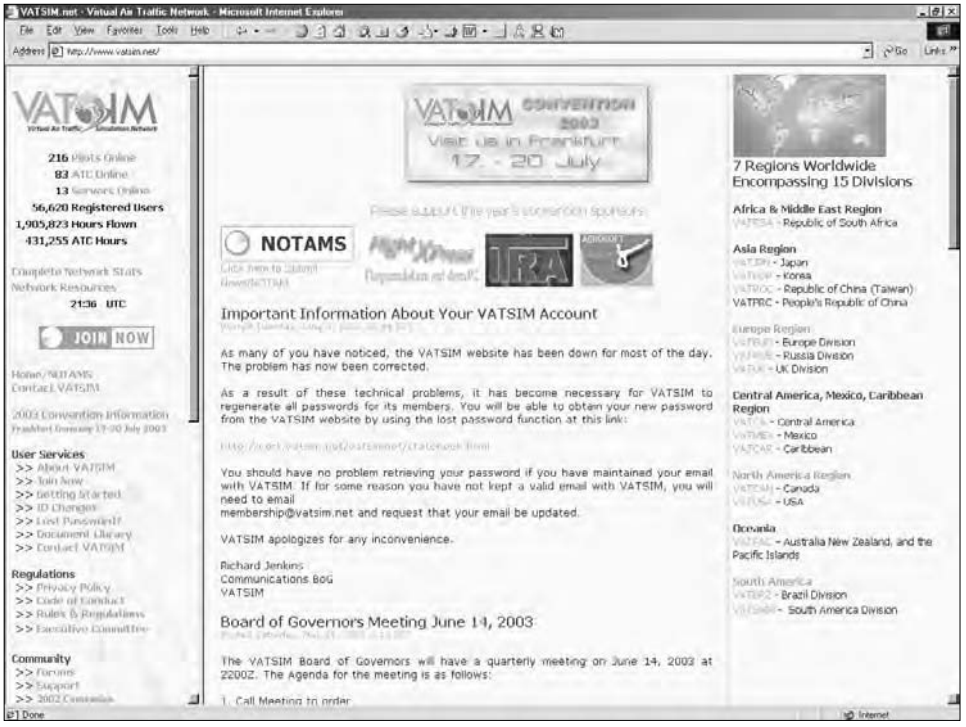


Figure 9.4: *VATSIM is a very popular multiplayer add-on for* Flight Simulator.

- **Roger Wilco** (http://rogerwilco.gamespy.com/): Roger Wilco is an Internet gaming staple that enhances the *Flight Simulator* experience considerably. (And it's a must if you want to utilize VATSIM's features.) Roger Wilco permits real-time voice communication over the Internet with the use of a microphone or headset mike. It's perfect for communicating with other pilots during a session.

- **FSNavigator** (http://www.fsnavigator.com): This add-on also is highlighted in Chapter 10, "*Flight Simulator* Community," but it's worth noting here because FSNavigator permits you to see everyone's location in the multiplayer session.

Tip *Aircraft, scenery, and other add-ons can be used in multiplayer sessions. If you wish to use specific scenery for your multiplayer simulated sessions (for instance, mountain flying in a particular area), ensure that all users have downloaded and installed the scenery. You should mention this in your session's name or in the flightboard description.*

Multiplayer Activities

The special thing about *Flight Simulator*'s multiplayer component is that it's entirely open-ended. Virtually anything you can think of to try can be done. You can host stunt shows or race a friend in deHavilland Comets. This section will give you some ideas, and provides information on multiplayer activities.

- **Virtual Airlines:** Certain *Flight Simulator* users have banded together to form virtual airlines, complete with logos, staffing, and flight schedules (see Figure 9.5). You can read more about virtual airlines in Chapter 10, "*Flight Simulator* Community," and at an online virtual airlines magazine at http://www.vamagazine.net.

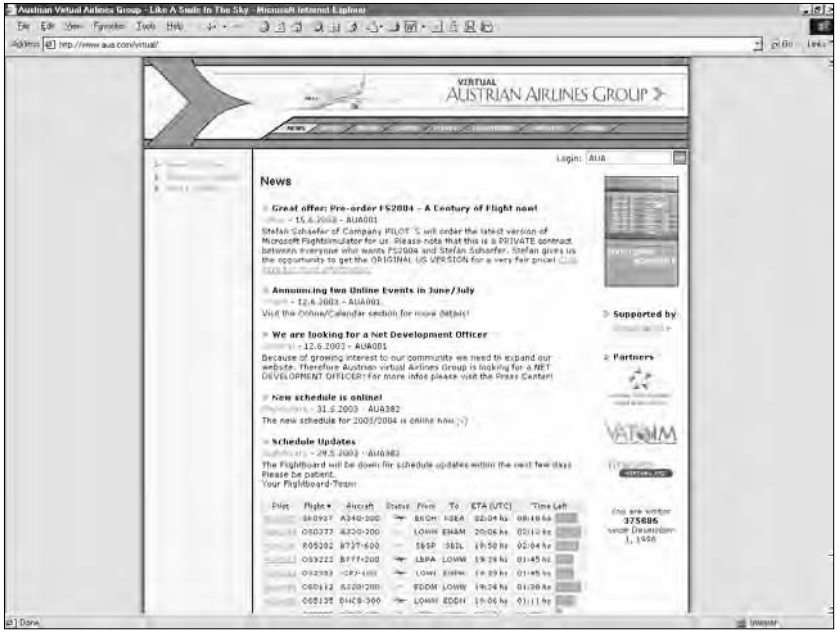


Figure 9.5: *Here's an example of a virtual airline.*

- **Air Races:** Set up a one-time or extended-time air race. Host a multiplayer session in which users race a particular model of aircraft from one airport to another. Or you could set up a multiple-leg race in which users must record their flights from airport to airport, and post their travel time. Add up the total time and the faster pilot wins the race!
- **Stunt Shows:** Host an aerobatic flying show at one of *Flight Simulator 2004*'s aerobatic boxes (a designated segment of airspace—3,300 feet long by 3,300 feet wide by 3,500 feet tall—in which aerobatic maneuvers take place and are judged). There are four aerobatic boxes marked in *Flight Simulator 2004*. These are south of 4SD in Reno, Nevada; west of KFLD in Fond du Lac, Wisconsin; east of KEPH in Ephrata, Washington; and southwest of KAVQ in Marana, Arizona. Use Roger Wilco to announce scores or congratulate users on completing a successful maneuver.

Tip *The Bush Net message forum at AVSIM.com (http://forums.avsim.com/dcboard.php?az=show_topics&forum=169) focuses on group bush flying. The Bush Net flyers host an active server for participants, and use Team Speak for voice communications. You can download this add-on at http://www.teamspeak.org. Read more about joining the Bush Net group in the message forum.*

- **Group Flying:** Create a flight or use one of the preset modern or historical flights available in *Flight Simulator 2004,* and have one or more flyers join you in a group flight experience. Maintain close formation and constant communication using Roger Wilco. Group flying is especially fun when sightseeing or bush flying.

Developer's Tip *The Barnstorming with Tex Marshall flights for the Curtiss "Jenny" are great for multiplayer group flying. Tex did these flights with a friend. Part of the challenge was navigating* and *keeping an eye on one another—especially when the weather got bad.*

- **Follow the Leader:** This is similar to group, or formation, flying, but with the emphasis on following your fellow pilot's every move. This is best played in fast, low flying—particularly through mountainous or urban terrain to increase the challenge level. It's an excellent way to see how well (or poorly) a particular aircraft handles.

Multiplayer Challenge

The Task: Set up a multiplayer one-on-one air racecourse and challenge an online user to friendly competition. Or design a course for two of your friends and see which pilot best adapts to its challenging conditions. Any aircraft can be used, though smaller and more maneuverable planes are best suited for racing. For the sake of this challenge, we suggest using the deHavilland DH-88 Comet, one of the historical aircraft included in *Flight Simulator 2004*—and one renowned for its air-racing ability.

Distribute the racecourse's flight plan (.PLN file) to any participants. Host a multiplayer session and give your IP address to the competitors. Load the flight plan and move your aircraft to the departure airport. Instruct the race's competitors to do the same and use Roger Wilco, or just in-game text chat, to announce the race's start and provide updates to any observers.

Tips: You can set up a course as a direct airport-to-airport race. The fastest to land successfully is the winner. Or you can set up the race with waypoints. Each pilot must navigate to each waypoint in turn, before reaching the final waypoint, the destination airport. The first to navigate all waypoints and successfully land at the destination airport is the winner.

Solution: Open the Flight Planner and select *Reno/Stead* (4SD) as the *departure* airport and *Blue Canyon-Nyack* (KBLU) as the *destination* airport. Select *Visual Flight Rules* and *Direct-GPS.* Press the *Find Route* button and see that the route is a direct line from airport to airport.

Here's how to set up an alternative course using waypoints: Return to the Flight Planner screen (use the *Create* tab at the top) and press your mouse button on the red *route line.* Drag the route line to another airport and create new waypoints for the course. Since this is a VFR flight, adding waypoints requires the competitors to spot the airport visually. Or you could permit use of the handheld GPS in the deHavilland to navigate to each waypoint.

Tip *If you're using an aircraft with navigation radios, you can set up routing with* Low Altitude Airways *or* VOR to VOR, *and see how the route changes to intersect a nearby low-altitude VOR (SWR: 113.20). Perhaps the race rules would require you to fly to that VOR before proceeding to KBLU.*

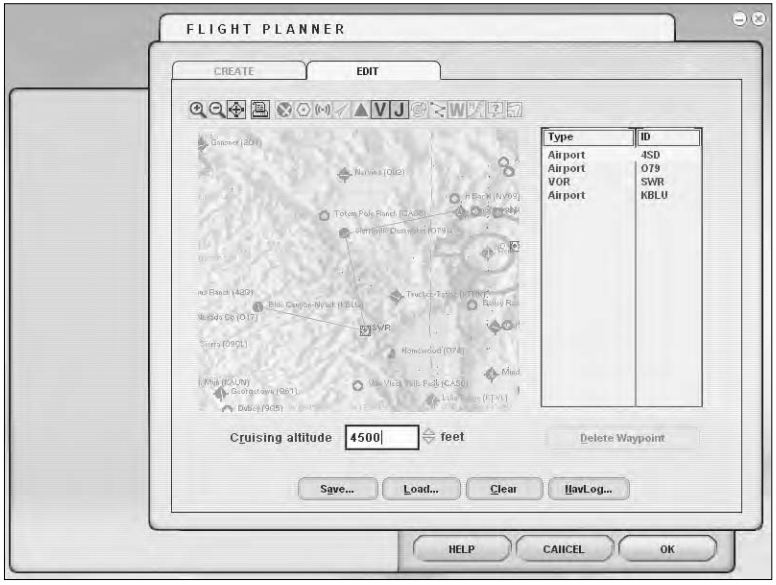


Figure 9.6: *Use the Flight Planner to set up course waypoints, such as other airports or navigational aids.*

Weather can greatly alter the level of difficulty of your racecourse. Use *FS 2004*'s extensive customization features to provide unique challenges at specific points in the race. For instance, you could change the weather at a specific station, providing a crosswind, headwind, or sudden rainstorm. Select *User-Defined Weather* from the *Weather* menu. Select *Specific weather station* and choose the weather station from the map. Any weather changes will be made directly to that specific station. Using *Advanced Weather*, you can also alter the weather at certain altitudes. This encourages participants to alter course and strategy to avoid tough conditions. Keep in mind that all participants must set the same weather conditions.

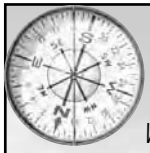
CHAPTER 10
Flight Simulator *Community*

Microsoft's* Flight Simulator *has a huge Internet fan base, and these real-world pilots, flying* aficionados*, and sim fans have developed some incredibly elaborate resources.

This chapter serves as an introduction to the vast* FS *community. The "Web Resources" section profiles six comprehensive flight-simulation sites, including Microsoft's own* Flight Simulator Insider. *Each site offers message forums; file databases featuring new aircraft, scenery, and utilities; and an array of helpful suggestions and tips. In "Add-ons and Accessories" we compile some of the best additions to* Flight Simulator. *Finally, the section on "Favorite Links" includes more than two dozen Web site addresses, with brief descriptions of the specific content of each, covering a wide range of topics.

Web Resources

Web sites devoted to flight simulation are your best source of user-made add-ons—utilities, new aircraft, alternate aircraft skins and logos, and dynamic scenery. These sites also offer great ways to become involved in the flight simulation community. Heavily frequented message boards present forums for simulation-related discussion, ideas for new flights, reviews of add-ons, and answers to technical questions. This section highlights six *Flight Simulator* resource sites, and steers you toward each site's best features and content.



Note *Except within* Flight Simulator Insider, *Microsoft does not moderate these sites. Microsoft can't offer technical support on these sites or on any of the add-ons that might be found there. If you have a question about a particular site, search the* about us *or* contact *section of that site and email the Webmaster for assistance. You can also find help in any of the sites' FAQ (frequently asked questions) areas, or by posting questions in a message forum.*

Microsoft's *Flight Simulator Insider*

The *Flight Simulator Insider* Web site (http://zone.msn.com/flightsim) is Microsoft's home for "all things flight simulation" (see Figure 10.1). The front page details the latest news, notes, and updates regarding Microsoft's *Flight Simulator* line, and offers links to new *Insider* articles. Top and side menu bars provide direct links to the site's wide range of content features, which cover such things as keyboard-shortcut tips, multimedia features on specific topics—e.g., the radio stack—and even flying lessons, focusing on specific topics such as instrument charts, or particular aircraft.

Figure 10.1: *The* Flight Simulator Insider *Web site is a great source for tips, customer service, and interviews with the* Flight Simulator *team.*

The *Insider* Web site links to Microsoft's *Simulation Store* (http://shop.ecompanystore.com/simulation/). You can find many entertaining—though not directly simulation-related—*Flight Simulator* products there, including apparel, bags, office accessories (like pens and tumblers), and specialty items such as watches and key chains.

The following are direct links to excellent *Flight Simulator Insider* content.

- **Readback** (http://zone.msn.com/flightsim/ReadbackIndex.asp): The *Flight Simulator* team answers questions straight from the flight simulation community.
- **Destinations** (http://zone.msn.com/flightsim/destinations.asp): *Flight Simulator* guides showcase challenging airports and spectacular scenery.
- **Tips Index** (http://zone.msn.com/flightsim/tipsindex.asp): The index is a compilation of the new flying lessons, basic skills, and insider tips available at the Web site.
- **Customer Service** (http://zone.msn.com/flightsim/FS02gettinghelp.asp): This is Microsoft's customer-service help page for *Flight Simulator*.

AVSIM Online

AVSIM Online (http://www.avsim.com) is one of the most comprehensive flight simulation resources on the Web. The site even sponsors an annual simulation exhibition and conference. (In 2003 it was held Sept. 26 and 27 in the Mid-Atlantic Air Museum at Carl Spatz Field in Reading, Pennsylvania.)

AVSIM is a prime source of third-party add-on software. Perhaps its best feature, however, is its extensive collection of *reviews* of add-ons. At the time of this writing, AVSIM housed 170 reviews of third-party aircraft, 81 reviews of third-party utilities, and 92 reviews of third-party scenery. Note that these reviews are for *FS 2002* add-ons, which—if their creators followed the guidelines in Microsoft's *Flight Simulator* SDK—should be compatible with *FS 2004*. All told, AVSIM offers 1,170 reviews of third-party content. Considering the huge number of third-party add-ons available to *Flight Simulator* users, AVSIM is an important resource for finding the best add-on software for you.

Below are direct links to invaluable AVSIM Online content.

- **Chat** (http://www.avsim.com/irc): AVSIM offers an Internet Relay Chat (IRC) system, and Web-based chat access. (Both are explained at, and linked to, this Web address.) AVSIM includes chat rooms specifically for VATSIM users, others just for general chat, and some for users such as bush flying enthusiasts.
- **File Library** (http://library.avsim.net/): At the time of this writing, AVSIM's file library held more than 31,000 files. Plenty of search options will help you find exactly what you're looking for. Search by keyword or browse only through uploads from the previous day—or any particular day.

- **Message Forums** (http://forums.avsim.com/): AVSIM has one of the largest message forums around. You'll find individual message boards dedicated to tips and tricks, general chat, aircraft and scenery design, bush flying, and flight plans. (The last is a great source of new flights to try, straight from other *Flight Simulator* users.) The forum also offers technical support for a wide range of third-party add-ons.
- **AVSIM Reviews** (http://www.avsim.com/pages/content.shtml): You can sort reviews of add-ons according to whether they're commercial or freeware, or you can choose to see reviews only of aircraft, scenery, panels, or other archived topics of your choice.
- **VFR Flight Center** (http://www.avsim.com/vfr_center/mainpages/vfr_flights_main_page.htm): AVSIM's VFR Flight Center is a compilation of thrilling VFR flights. It also provides complete instruction (and links to applicable third-party scenery, if necessary) for setting up the flights.

FlightSim.Com

With monthly contests, extensive FAQs (frequently asked questions), *tips and tricks* sections, and premium coverage of third-party add-on software, FlightSim.Com (http://www.flightsim.com) serves the simulation community with well-rounded content that keeps its readers involved. A monthly contest at the site asks readers to vote on their favorite new addition to the file library. As they say, it's "the 'people's choice' award for makers of flight simulation add-ons." Winners are given a wall plaque and the right to use the FlightSim.Com *Developer's Award* logo.

FlightSim.Com houses many of the features you'd expect from an Internet resource, including a large file library, numerous message boards, and product reviews. Here's a welcome feature: You can check the message boards for the *Live Flightboard. Flight Simulator* users post their flights-in-progress and provide IP addresses so you can join them on their multiplayer server.

Here are several direct links to useful FlightSim.Com content.

- **How-tos** (http://www.flightsim.com/cgi/kds?$=main/m-howto.htm): Among this extensive section's *how-to* topics are articles on building do-it-yourself cockpit hardware, and on creating and sharing screenshots from flights.
- **Developer Spotlight** (http://www.flightsim.com/cgi/kds?$=main/m-who.htm): FlightSim.Com spotlights developers with its monthly contest and with a *Who's Who* section. Past contest winners are archived, so you can read about and download their award-winning add-ons (see Figure 10.2).

Figure 10.2: *The insightful* Developer Spotlight *at FlightSim.Com—which includes this* Who's Who *section—helps steer you to the best add-on content.*

- **Top 100 Files** (http://www.flightsim.com/cgi/kds?$=main/top.htm): Use this link for direct access to FlightSim.Com's top 100 files of the year.
- **Industry Announcements** (http://www.flightsim.com/cgi/kds?$=main/m-notams.htm): An excellent source of flight simulation news and notes, including announcements of new add-ons.

simFlight Network

The simFlight Network (http://www.simflight.com) is, as its title suggests, a network of flight simulation sites (forums, file libraries, a store). The network offers support for non-English-speaking users, with links to companion sites in German, French, Portuguese, Dutch, and Spanish.

simFlight's well-designed layout invites readers into the site with an array of links showing the newest message-forum posts by subject, past-article archives, and (frequently updated) news. The top menu bar provides quick links into valuable sections such as *Reviews, Newsgroups,* and specialty *Forums,* such as simFlight's *Virtual Airlines* board.

The following are direct links to some must-see simFlight Network content.

- **Screenshot Competition** (http://forums.simflight.com/viewforum.php?f=5): The simFlight Network runs monthly screenshot contests with prizes (from listed sponsors). Be sure to read the *rules* post for contest information, and to follow the *past winners* link (http://www.simflight.com/~screen/) for examples of beautiful *Flight Simulator* shots. Participants post their entries directly into the forum, with brief descriptions.
- **History of *Flight Simulator*©**: Still in development, Jos Grupping's retrospective on more than 20 years of flight-simulation products includes a profile of flight simulation pioneer Bruce Artwick and an intriguing timeline (e.g., Microsoft released *Flight Simulator 1.0* for the IBM-PC in 1982, with four-color graphics, four choices of scenery, 20 airports, and the Cessna 182).

Tip *Getting involved in the* Flight Simulator *community is easy. Find your favorite flight simulation site among those listed here and register for the* message forum *(links to the registration process typically can be found in the forum itself.) Compose a note introducing yourself and post it in the site's general flight simulation forum. Participate in other post "threads," communicate with other online multiplayer fans, and host or join a server to enjoy the simulation with other players.*

- **simFlight Forums** (http://forums.simflight.com/): Plenty of support forums for add-on products can be found here, along with specialty forums for "bush pilots," virtual-airline users, and others. Here's a direct link to simFlight's *FS 2004* forum: http://forums.simflight.com/viewforum.php?f=48.
- **simFlight Newsgroups** (http://snn.simflight.com/): An alternative to the Web site's message boards, simFlight newsgroups also cover a wide range of topics, including *FS 2004*, aircraft and scenery design, and VATSIM.

Simviation

Simviation (http://www.simviation.com) serves all levels of *Flight Simulator* users. A *help and tutorial* section offers new users quick guides to the installation of third-party add-on software, and to designing their own aircraft, panels, and scenery. Advanced users can dive directly into the *utilities and downloads* section, divided logically by aircraft types, utilities, and other categories, such as *adventures, sounds,* and *splash screens* (which also make great Windows wallpaper).

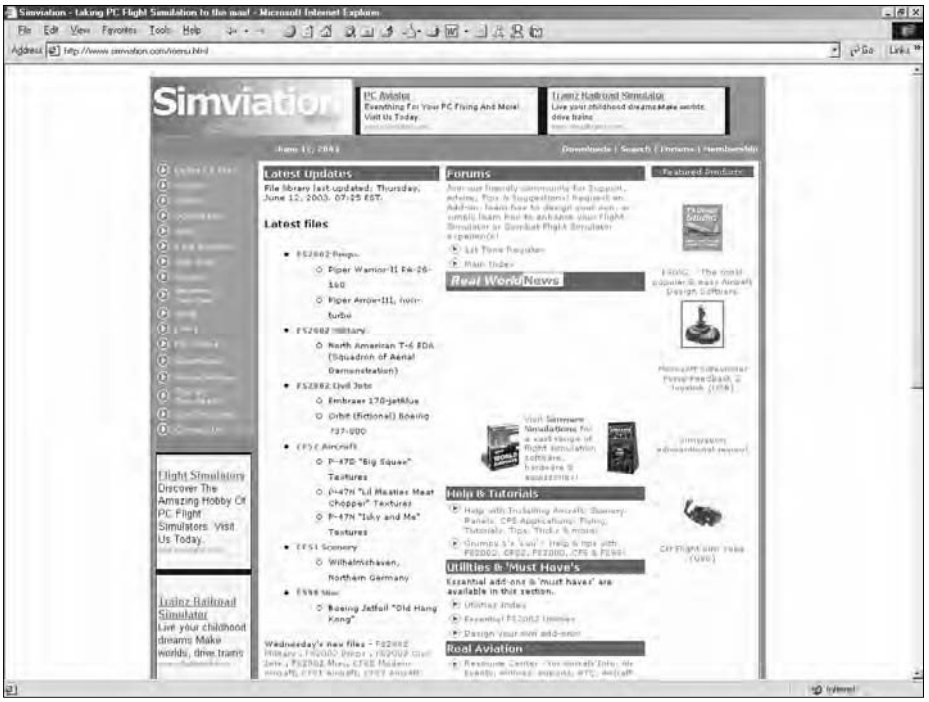


Figure 10.3: *Simviation is a solid, all-around flight simulation site, with something for beginners and veterans alike.*

The following are some direct links to Simviation content.

- **Multiplayer Flightboard** (http://www.simviation.com/fsdflightboard.htm): Simviation's *flight board* includes an informative FAQ on using the flight board, and additional information on playing online.
- **Message Board** (http://www.simviation.com/cgi-bin/yabb/YaBB.cgi): A wide range of message boards is offered here, including design forums, a screenshot gallery (and custom made screenshots and real photos), forums on computer hardware and software, and classified-ad sections.
- **Aviation Information** (http://www.simviation.com/realhome.htm): Simviation's *real aviation* area compiles ample real world aviation information—aircraft statistics, fuel data, airport links, aviation events, and live airport Web cams!
- **Design Utilities** (http://www.simviation.com/fsdutilsdesn.htm): Simviation has an instructive section on designing your own aircraft, panels, and scenery. Links to all the tools you need are provided, and tutorials walk you through some of the processes. Use this in conjunction with Simviation's *design* message boards, if you have any questions or need additional help.

FSPlanet.com

Visited by more than 24,000 flight simulation users each day, FSPlanet.com (http://www.fsplanet.com) focuses its efforts on an extensive file library. The large database houses numerous freeware utilities, as well as aircraft and scenery files. You'll also find links to commercial add-on software available at the FSPlanet.com *store*.

Here are several direct links to FSPlanet.com content.

- **Newest Files** (http://www.fsplanet.com/new01.htm): Use this quick link to browse the newest files available at FSPlanet.com.
- **Best of the Best** (http://www.fsplanet.com/best.htm): This link steers you directly to the highest rated files at FSPlanet.com. Click the *Next* link at the bottom of the page to continue to subsequent file pages of highly rated add-ons.
- **Airlines** (http://www.fsplanet.com/airlines.htm): If you're hunting for a particular airline model (for instance, you're eager to download a United Airlines plane), use this link. You'll find a list of airlines inside. Just click on the airline you wish to download, and you're sent into the file library at the appropriate location.
- **Reviews** (http://www.fsplanet.com/reviews.htm): Browse reviews of user-made *Flight Simulator* add-ons written by FSPlanet.com users.

Add-Ons and Accessories

Note Flight Simulator 2004: A Century of Flight *supports all commercial and freeware add-ons created for* FS 2000 *and* FS 2002*—as long as their creators followed the guidelines in Microsoft's* Flight Simulator Software Developer's Kit *(SDK). If an add-on isn't working, consult the add-on's* read me *file, or ask the creator directly for technical support, via e-mail.*

One of *Flight Simulator*'s most exciting and long-standing features is its ability to utilize the thousands of add-ons and accessories created by simulation fans all over the world. These additions can add significantly to your enjoyment of Microsoft's *Flight Simulator*.

Search the *FS* community links throughout this chapter for file libraries and databases housing these add-on products, and for information on using them. This section provides links to valuable *Flight Simulator* add-ons and accessories, including aircraft, scenery, utilities, and charts.

Aircraft and Scenery

New aircraft and scenery can enhance and extend your enjoyment of *Flight Simulator*. Numerous *commercial* aircraft and scenery add-ons can be found in a search of the *store* links on the Web sites listed earlier in this chapter (or on sites like AVShop and Flight1.com, listed in the *favorite links* section later in this chapter). But plenty of *freeware* options are available to those seeking an inexpensive way to expand their horizons.

To install add-ons, read the documented instructions, or *read me* files, included with each of these products. If you have technical questions, email the add-on's creator. The email address is typically included in the instructions.

The following are specific links to add-on *aircraft* and *scenery,* ready and available for download. Keep in mind that these are just a few of the thousands of aircraft and scenery add-ons that can be found on the Internet (see Figure 10.4). Check the file libraries of the Web sites mentioned earlier in this chapter to search for many, many others.

- **Boeing 737-800** American Airlines: http://library.avsim.net/sendfile.php?DLID=30651

Figure 10.4: Flight Simulator *users have created fantastic add-on aircraft and scenery.*

- **DeHavilland DHC-3T** Super Otter Amphibian: http://library.avsim.net/sendfile.php?DLID=30161
- **Venezuelan Andes** Terrain: http://library.avsim.net/sendfile.php?DLID=31321
- **Alaska** Bush Scenery, Coghill Lake: http://library.avsim.net/sendfile.php?DLID=31080
- **Las Vegas Strip:** http://library.avsim.net/sendfile.php?DLID=29146
- **Thai Airways DC-10-30:** http://library.avsim.net/sendfile.php?DLID=29622

Utilities

As with *aircraft* and *scenery,* there are hundreds of handy *Flight Simulator utilities* available for download at each resource site's file library. (Check the Web sites to ensure that these utilities have been updated and are compatible with *Flight Simulator 2004: A Century of Flight*.)

WARNING

Remember again that these utilities have been designed for previous versions of Flight Simulator. *Most of the time, the designers update the utilities for use in the current version of* Flight Simulator. *Be sure to read all documentation and associated files to ensure that compatibility of the add-on.*

These custom features can truly enhance your enjoyment of the *FS 2004.* Note that some of them require a fee for registration. Consult the Web site's *support* or *help* section for further information on using and installing each utility.

Here are some useful and fun utilities to try with *Flight Simulator*.

- **FSNavigator** (http://www.fsnavigator.com): This program helps create detailed flight plans, using its own interface. It includes detailed airport and navigation data. The flight plans can be exported into *Flight Simulator* or VATSIM. Here's a great site with tips on using FSNavigator and creating your own flight plans: http://www.airpacifica.org/ceo/tips_2003feb_fsnav-simple.htm.

Note *For more on other* Flight Simulator *utilities like VATSIM and Roger Wilco, see Chapter 9: "The Multiplayer Skies."*

- **FSBuild** (http://ourworld.compuserve.com/homepages/alstoer1/fsbuild.htm): Another flight planner and builder. This Web site offers three helpful tutorials and a message forum where you can discuss FSBuild with other users.
- **FS Boarding** (http://library.avsim.net/sendfile.php?DLID=12971): This utility allows you to see simulated passengers embarking on your airliner!
- **A.I. Traffic Mover** (http://library.avsim.net/sendfile.php?DLID=24026): Traffic Mover makes A.I. traffic more realistic, with tools to rearrange, move, export, and edit aircraft, compile flight plans, and set time sheets for arrivals and departures.

Charts

Real-world flight charts can enhance your flight simulation experience. Having printed charts on hand further simulates a real flight; as you need important airport or navigation data, refer to the flight chart on your own kneeboard. This section highlights Web sites and programs that offer real-world flight charts (see Figure 10.5).

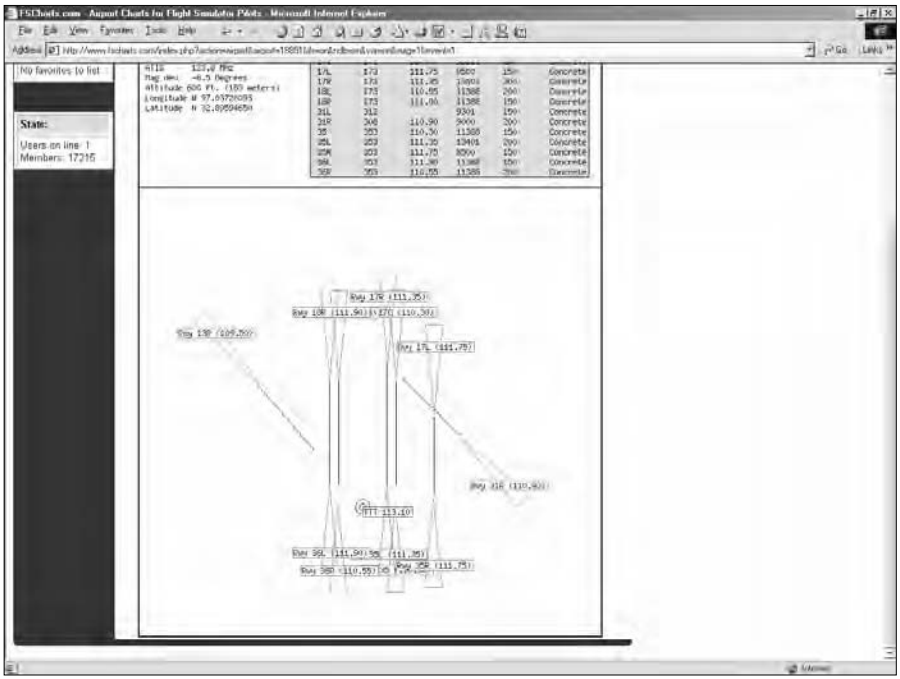


Figure 10.5: *Real-world flight charts, such as these at* FS Charts, *include important airport data and approach vectors.*

- **Jeppessen:** SIMCharts, created by Jeppesen, can be used to sort, view, and print realistic terminal charts. The product includes more than 25,000 airports in twelve coverage areas. SIMCharts are used for simulation only (hence the name), although they are quite similar to their real-world counterparts. The Web site (http://www.jeppesenpcpilot.com/about.phtml) includes information about SIMCharts, an FAQ page, and a free demo. Although the demo is fully functional, it does limit the charts available for view. Visit the online store for additional accessories, including service binders, chart organizers, and chart wallets.
- **FSCharts.com:** A Web site (http://www.fscharts.com) created by *Flight Simulator* fan Ken Peters offers airport information on more than 22,000 airports worldwide. Charts include runways, headings, and frequencies for the selected airports, and can be customized to include only the information you need. FSCharts.com requires membership, though registration is completely free. (At the time of this writing, there are nearly 17,000 members.)

Favorite Links

The following table offers a mix of our favorite informative, useful, and downright invaluable *Flight Simulator* Web site links, from among the *thousands* of Internet sites related to flight simulation. Be sure to visit each site's link pages, for even more places of interest.

WEB SITE	COMMENTS
http://www.aerodynamika.com/cgi-bin/freeflight.cgi	The *Freeflight Design Shop* forum is a useful resource for those interested in *Flight Simulator* aircraft design.
http://www.aerosite.net	Aerosite features airliner and aircraft profiles, and offers hundreds of airliner logos.
http://www.airlineandairportlinks.com	This site provides a database of links for airliners and airports, sorted by city, region, or airport code. You can also browse dozens of real airline photos.
http://www.airliners.net	An excellent place to find aircraft pictures.
http://www.atcsimtech.com	This unique ATC simulator allows you to assume the role of an approach or departure controller. The program even features voice-recognition support.
http://www.av8n.com/how	*See How It Flies*, by John S. Denker, is a massive database on the principles of flight.
http://www.avshop.com/index.html	The AVShop offers aircraft supplies, charts, IFR training materials, headsets, and various accessories to enhance your *Flight Simulator* experience. It's particularly useful if you're using *Flight Simulator* as a training aid.
http://www.awfulweather.com	*Awful Weather*, by Jordan Langelier, allows you to enter a set of weather conditions (such as wind speed, visibility, rain, snow, and thunderstorms), and it will find the spot on the globe where that weather is *currently occurring*. Use *FS 2004's* real-world weather features, then go to that location and fly in that weather!
http://www.clearanceunlimited.com	This Web site, focused on flight simulation navigation, features a database of airport data, tutorials, and flight plans.
http://www.computerpilot.com	The home page for *Computer Pilot Magazine*. The Web site details each monthly issue, and has several discussion forums allowing the magazine's writers, readers, and other site visitors to interact.
http://www.dangerous-airports.com	Looking for a landing challenge? *Dangerous Airports* lists (and rates the danger-level of) airfields that should meet any request. Handy info links provide the reasons for the danger.
http://www.dreamfleet2000.com	Dreamfleet is referenced frequently by the *Flight Simulator* community as one of the best creators of commercial aircraft add-ons. A favorite is the Cessna 177B Cardinal.
http://www.flight1.com	Flight1.com offers commercial *Flight Simulator* add-ons, including aircraft, scenery upgrades, and utilities, for sale.
http://www.frugalsworld.com	Frugal's World of Simulation is an excellent resource covering various simulation products, especially flight simulation.
http://www.fsdome.com	FS Dome houses a large library of *Flight Simulator* add-ons.
http://www.fsgateway.com	FS Gateway is an excellent all-purpose *Flight Simulator* resource, with a large *tips and tricks* section, a screenshot gallery, and a message forum.

WEB SITE	COMMENTS
http://www.howstuffworks.com/airplane.htm	How an airplane works—straight from the *How Stuff Works* Web site.
http://www.jetdoc.com	This is a great source of information on adding A.I. airplanes and A.I. traffic.
http://www.kingschools.com	The Web site home of John and Martha King, your instructional hosts in *A Century of Flight.*
http://www.microsoft.com/games/flightsimulator	Microsoft's home page for *A Century of Flight.*
http://www.mikesflightdeck.com	Mike's Flight Deck is a unique site, focused solely on the process of building simulated cockpits and flight decks.
http://www.pcaviator.com	Supplier of a wide range of flight simulation products, including gear, accessories, and commercial add-ons.
http://www.projectai.com	Project A.I. is a volunteer group recreating real-world air traffic inside *Flight Simulator.*
http://www.rodmachado.com	Homepage of Rod Machado, legendary flight instructor and your tutorial host in *A Century of Flight.*
http://www.tooby.demon.co.uk/FS2002/FS2002_Assistant.html	The Pilot's Assistant is a virtual A-to-Z index of "all things flight simulation."
http://www1.faa.gov/ATpubs/AIM/index.htm	Real-world aviation guide to flight basics and ATC procedures.
http://www2.faa.gov/atpubs/PCG/index.htm	A large, informative pilot and air traffic controller glossary.
http://zone.msn.com/flightsim/FS02DevDeskSDK00.asp	Microsoft's Developer's Desk. Those looking to create add-ons should keep an eye on this page.

APPENDIX A
Common Problems for New Users

This appendix offers guidance for users new to* Flight Simulator *by providing quick answers to many common problems. The table offers a brief solution and tells you where to find more information on the topic in* FS 2004*'s Learning Center and its "Flying Lessons" section, and also in this strategy guide.

PROBLEM	SOLUTION	LEARNING CENTER AND FLYING LESSONS	STRATEGY GUIDE
I'd like to improve *Flight Simulator*'s graphical performance.	Reduce your *Display* settings, beginning with the resolution setting in the *Hardware* section. Once you achieve acceptable performance, begin increasing the settings in the *Scenery* section.	Optimizing Visuals and Performance	Chapter 1
What's the best way to balance performance and graphical clarity?	Use the *Target Frame Rate* slider in the *Hardware* section. Set a desirable frame rate (for most players, at around 20 frames per second) and maintain that frame rate as you adjust other detail settings.	Optimizing Visuals and Performance	Chapter 1
My controller isn't working in *Flight Simulator*.	Read the "Troubleshooting Controllers" section in Chapter 1.	Joysticks, Yokes, Throttles, and Pedals	Chapter 1
I'm finding handling the aircraft too difficult.	Try lowering the *Realism* settings.	Basic Aerodynamics and Maneuvers	Chapter 1
The preset weather themes are awesome but I'd like to set up my own weather for different locations and altitudes.	Select weather settings on the *Create a Flight screen* and choose *User-Defined Weather*. From there you can set specific weather for different weather stations and altitudes.	Weather	Chapter 4, Chapter 5
How do I set up waypoints in the Flight Planner?	In the Flight Planner, click on the flight path and drag it to a navigational aid or airport to create a waypoint for the flight.	Flight Planner	Chapter 9
How do I get information on navigational aids and airports from the Flight Planner?	In the Flight Planner, put your cursor over the navigational aid or airport, or click the navigational aid or airport, for more detailed information.	Flight Planner	Chapter 5, Chapter 8
I don't understand the difference between Visual Flight Rules and Instrument Flight Rules, and how it applies to my flight planning.	In brief, Visual Flight Rules (VFR) require that you be able to *see* well enough to find your way. The generally accepted definition of VFR is minimum flight conditions of: 1. 1,000 foot ceiling and 2. 3 nm visibility Any conditions that fall below either of these thresholds are considered to be instrument meteorology conditions (IMC). In IMC you navigate under Instrument Flight Rules (IFR), by reference to instruments and under Air Traffic Control on an IFR flight plan. This is a quick explanation; a deeper explanation should be explored in the Learning Center and in the appropriate chapter.	Navigation	Chapter 5, Chapter 6

(continued on next page)

PROBLEM	SOLUTION	LEARNING CENTER AND FLYING LESSONS	STRATEGY GUIDE
		(CONTINUED FROM PREVIOUS PAGE)	
I'd like to learn about the dynamics of flight.	Take the "Student Pilot" lessons with Rod Machado and read all of the articles included with the lessons.	"Student Pilot" lessons, Basic Aerodynamics and Maneuvers	Chapter 4
I'd like to set up a simple flight using the easiest navigation possible.	Use the Flight Planner to set up departure and destination airports, and select *Direct-GPS* for routing. During the flight, toggle the GPS to see a line marking your flight path. Maintain your heading on the line to navigate directly to your destination.	Flight Planner, Navigation	Chapter 5, Chapter 6
Air Traffic Control refuses to give me clearance for takeoff .	In bad or "iffy" weather conditions, pilots must file an Instrument Flight Rules flight plan with ATC before takeoff.	Flight Planner	Chapter 5
My airliner is at the gate and I can't get onto the taxiway.	Use Shift+P to pull back from the gate. Once you're back far enough, press Shift+P again and use your throttle to increase power to taxi speed.	Flying Jets	Chapter 5
I'm flying the *Spirit of St. Louis* and there's no front window! How do I see?	The *Spirit of St. Louis* doesn't have a front window. On the ground, many of the other historical planes are *taildraggers*; their noses ride high, blocking the view forward. You can raise your eye level with Shift+Enter, or press W to remove the cockpit panel.	Taildraggers, Views and Windows	Chapter 3, Chapter 5
I can't control the aircraft on the taxiway.	Use gentle rudder to control your direction on the taxiway. If you're still having problems, you're probably going too fast. *Taxi* speed is a brisk walking pace, for most planes. Refer to the flying tips in this strategy guide for taxi instructions.	Aircraft Information	Chapter 2, Chapter 3
I'm having trouble staying on the runway centerline during takeoff.	There are three most common reasons. 1. P-Factor (or torque) left turning tendency 2. Crosswind 3. Pilot over control For P-Factor, apply gentle right rudder as you increase power. For Crosswind apply rudder and aileron into the wind prior to lift off. For over control, use gentle rudder corrections for directional control on the runway during takeoff. In stronger winds, counter the wind with ailerons.	Learning Center "Flying Lessons" on takeoffs	Chapter 5

PROBLEM	SOLUTION	LEARNING CENTER AND FLYING LESSONS	STRATEGY GUIDE
The plane pulls left during takeoff.	Your *Realism* settings are set high, and you're experiencing the effects of torque and p-factor. Reduce *Realism* settings or reduce torque and p-factor.	Basic Aerodynamics and Maneuvers	Chapter 1
How can I take off earlier, as from a short field?	Decrease fuel, which decreases weight. Increase flaps for takeoff.	"Flying Lessons" on takeoffs	Chapter 5
The nose of my plane shifts erratically left and right during flight.	Turn on *Autorudder* in the Realism settings until you're more comfortable with rudder control.	Basic Aerodynamics and Maneuvers	Chapter 4
I have to make continuous adjustments to my aircraft's pitch to maintain altitude.	Adjust the plane's *elevator* trim.	Cockpit Basics	Chapter 4
What's the difference between high altitude and low altitude VOR?	There are actually three classes of VORs. 1. Terminal (T-Class) Best used for navigation between 1,000 and 12,000 feet with an accepted range of 25 nm. 2. Low (L-Class) Transmissions are functional below 18,000 feet, with a reception range of about 40 nm. 3. High (H-Class) Also work below 18,000 feet, but have a reception range of 130 nm between 18,000 ft and 45,000 feet.	Navigation	Chapter 6
My needle on my VOR indicator isn't moving and I know I'm close to the VOR.	Check your radio stack and ensure that the VOR's frequency has been input into the appropriate NAV radio and that it's active. The NAV-GPS toggle should be set on *NAV*. As you get close to the VOR your needle will begin to move away. As you pass over a VOR, you enter "the cone of confusion" an area of no signal. The range of inactivity increases as your altitude increases above the VOR at an approximate rate of 1 nm for every 3,000 feet of altitude above the VOR. As you pass over the VOR you will lose the signal. Maintain the desired heading for number of miles per the above formula. You should see the needle reactivate and indicate appropriately.	Navigation	Chapter 6

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PROBLEM	SOLUTION	LEARNING CENTER AND FLYING LESSONS	STRATEGY GUIDE
			(CONTINUED FROM PREVIOUS PAGE)
I'm flying toward the heading the VOR indicates but it seems I'm now going the wrong way.	The needle on your CDI doesn't point to the VOR but indicates your position relative to the VOR. Adjust your plane's heading slightly in the needle's direction and line the needle with the indicator. General procedure for VOR tracking: 1. Tune the VOR frequency into appropriate NAV radio and identify the correct signal. 2. Tune the OBS heading on the top to match the course you wish to fly TO the VOR. 3. Make sure the TO/FROM flag says TO. 4. When passing over the VOR, tune the new OBS heading to match the course you wish to fly away from the VOR. 5. Make sure the TO/FROM flag indicates FROM.	"VOR Navigation" lesson, Navigation	Chapter 6
I'm having a lot of trouble getting the autopilot to maintain my heading, speed, and altitude. I turned it on! What else is there to do?	Consult the "Why Isn't the Autopilot Working?" sidebar in Chapter 6, "In-Flight Navigation."	Autopilot	Chapter 6
I'm attempting an ILS landing. The glide slope doesn't appear on my horizontal situational indicator (HSI).	Make sure you have input the ILS frequency (not a VOR or LOC only frequency) into NAV 1 on the radio stack, and make it active. Toggle the NAV-GPS switch to *NAV*. Follow the altitude requests from ATC.	"Instrument pilot" lessons, Navigation	Chapter 7, Chapter 8
The autopilot will not capture the glide slope on an ILS approach.	For best practical results, you must intercept the glide slope from below and at an appropriate speed for the aircraft. Too fast, and the autopilot will not lock on to the signal.	"Instrument pilot" lessons, Navigation	Chapter 7, Chapter 8
How can I know when to begin my descent to my destination airport?	Use the *rule of three*. Take your cruise altitude and subtract your destination's altitude. Divide the result by 1,000 and multiply by three. The result is the number of nautical miles from your destination at which to begin your descent.	Aircraft Information	Chapter 2, Chapter 3, Chapter 7
How fast should I descend?	Check your indicated speed, divide by two, and multiply by 10. The result is your descent rate in feet per minute.	Aircraft Information	Chapter 2, Chapter 3, Chapter 7

PROBLEM	SOLUTION	LEARNING CENTER AND FLYING LESSONS	STRATEGY GUIDE
I'm having trouble maintaining situational awareness.	Here's an excellent tip from *Flight Sim* enthusiast Geof Applegate: "Situational awareness is easy to lose when flying. Always look at the bottom of any particular instrument (e.g., heading indicator, VOR, NDB). That is where you are. The top of the instrument is where you're going. For example: You're tracking a VOR to an airport, and need to ascertain your position. Look at the bottom of your heading indicator. If it's showing *northwest*, you're northwest of the airport."	Navigation	Chapter 6
Lining up for landing is difficult; I'm either too high or too low.	Read the articles included with the "Student Pilot" lesson on landing. The related graphics provide a visual reference.	"Student Pilot" lessons	Chapter 7

APPENDIX B
Checklists

This appendix is a compilation of checklists for each plane, both modern and historical, available in* Flight Simulator 2004: A Century of Flight*. Use these checklists as references during all stages of pre-flight, flight, and post-flight routines. Consult Chapter 2 and Chapter 3 for further information and data on these aircraft.

Note: Each aircraft's real-world checklists have been modified for use with* Flight Simulator*. These checklists are accurate for* A Century of Flight *only, and are not meant to be substitutes for real checklists used with actual planes.

Beechcraft Baron 58

BEFORE STARTING

☐ Parking Brake	SET (press Ctrl+Period key)
☐ All Avionics	OFF
☐ Landing Gear Handle	DOWN (press G to toggle)
☐ Cowl Flaps	CHECK OPEN
☐ Fuel Selectors	CHECK ON (press Shift+4 to display throttle quadrant)
☐ All Switches and Equipment Controls	CHECK
☐ Battery and Alternator Switches	ON
☐ Fuel Quantity Indicators	CHECK QUANTITY
☐ Landing Gear Position Lights	CHECK

STARTING

Press Ctrl+E to initiate engine autostart sequence, or:

LEFT ENGINE:

Press E, then 1, to move focus to left engine.

☐ Mixture Control	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Propeller Control	HIGH RPM (press Ctrl+F3 until fully forward)
☐ Throttle	FULL OPEN (press F3 until fully forward)
☐ Fuel Boost Pump Switch	HI (until fuel flow peaks, then OFF)
☐ Throttle	CLOSE; then OPEN approx. 1/2 INCH (press F3 until fully in, then press F2 as necessary)
☐ Magneto/Start Switch	START position; release to BOTH position when engine starts (press M+Plus key to R, L, Both, Start)
☐ Throttle	900–1,000 RPM (after start)
☐ Oil Pressure	10 PSI WITHIN 30 SECONDS
☐ Warm-up	900–1,000 RPM
☐ Alternator Switch	ON
☐ Loadmeters and Voltmeter	CHECK FOR BATTERY CHARGE
☐ Red START Annunciator Light	CHECK (should be illuminated during start and extinguished after start)

RIGHT ENGINE:

Press E, then 2, to move focus to right engine.

☐ Mixture Control	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Propeller Control	HIGH RPM (press Ctrl+F3 until fully forward)
☐ Throttle	FULL OPEN (press F3 until fully forward)
☐ Fuel Boost Pump Switch	HI (until fuel flow peaks, then OFF)
☐ Throttle	CLOSE; THEN OPEN APPROX. 1/2 INCH (press F3 until fully in, then press F2 as necessary)
☐ Magneto/Start Switch	START position; release to BOTH position when engine starts (press M+Plus key to R, L, Both, Start)
☐ Throttle	900–1,000 RPM after start
☐ Oil Pressure	10 PSI WITHIN 30 SECONDS
☐ Warm-up	900–1,000 RPM
☐ Alternator Switch	ON
☐ Loadmeters and Voltmeter	CHECK FOR BATTERY CHARGE
☐ Red START Annunciator Light	CHECK (should be illuminated during start and extinguished after start)

Press E, then 1, then 2, to move focus to both engines.

AFTER STARTING AND TAXI

☐ Avionics	ON, AS REQUIRED (press Shift+2 to display radio stack)
☐ Exterior Lights	AS REQUIRED
☐ Brakes	RELEASE AND CHECK (press Period key)

BEFORE TAKEOFF

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Fuel Boost Pumps	OFF (if ambient temperature is 32 degrees C or above, use LOW pressure boost)
☐ All Instruments	CHECKED
☐ Fuel Indicators	CHECK QUANTITY INDICATED
☐ Mixture	ADJUST AS REQUIRED BY FIELD ELEVATION WHEN SETTING FULL POWER FOR TAKEOFF
☐ Fuel Selectors	CHECK ON
☐ Red START Annunciator Light	CHECK (should be illuminated during start and extinguished after start)
☐ Throttles	2,200 RPM (press F2 and F3 as necessary)
☐ Propellers	EXERCISE (to obtain 200-300 rpm drop, then return to high rpm) (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Throttles	1,700 RPM (press F2 and F3 as necessary)
☐ Magnetos	CHECK <150 rpm drop on each; <50 rpm drop between them (Press M+Minus key and M+Plus key to L, R, L, Both)

☐ Throttles	1,500 RPM (press F2 and F3 as necessary)
☐ Propellers	FEATHERING CHECK (Do not allow an rpm drop of more than 300 rpm)
☐ Throttles	IDLE (note rpm) (press F2 as necessary)
☐ Throttles	900–1,000 RPM (press F2 and F3 as necessary)
☐ Trim	AS REQUIRED FOR TAKEOFF (with Num Lock off, press Num Pad 1 and Num Pad 7 as necessary)
☐ Flaps	CHECK AND SET FOR TAKEOFF (press F6 and F7 as necessary)
☐ Flight Controls	CHECK PROPER DIRECTION AND FREEDOM OF MOVEMENT
☐ Ice Protection Systems	AS REQUIRED
☐ Parking Brake	OFF (press Period key)

TAKEOFF

☐ Minimum Takeoff Oil	24 degrees C
☐ Throttles	FULL (press F3 until fully forward)
☐ Propellers	MAX RPM (press Ctrl+F3 until fully forward)
☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Airspeed	ACCELERATE TO AND MAINTAIN RECOMMENDED SPEEDS (see Reference tab)
☐ Landing Gear	RETRACT (when positive rate of climb is established) (press G)
☐ Airspeed	ESTABLISH DESIRED CLIMB SPEED (when clear of obstacles)

CLIMB

☐ Throttles	FULL (press F3 until fully forward)
☐ Propellers	2,700 RPM (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Mixture	LEAN AS REQUIRED (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)
☐ Cowl Flaps	OPEN
☐ Airspeed	105 KIAS

CRUISE CLIMB

☐ Throttles	FULL (press F3 until fully forward)
☐ Propellers	2,500 RPM (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Mixture	LEAN AS REQUIRED (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)
☐ Cowl Flaps	AS REQUIRED
☐ Airspeed	136 KIAS
☐ Engine Temperatures	MONITOR
☐ Fuel Boost Pumps	AS REQUIRED

CRUISE

☐ Cowl Flaps	CLOSED
☐ Power	SET (press F2 and F3 as necessary)
☐ Fuel Boost Pumps	AS REQUIRED
☐ Mixtures	SET USING EGT

DESCENT

☐ Altimeter	SET (press B to autoset to current setting)
☐ Mixture	ENRICH AS REQUIRED (press Ctrl+Shift+F3 and Ctrl+Shift+F2 as necessary)
☐ Cowl Flaps	CLOSED
☐ Flaps	AS REQUIRED (press F6 and F7 as necessary)
☐ Power	AS REQUIRED (avoid prolonged idle settings) (press F2 and F3 as necessary)

BEFORE LANDING

☐ Fuel Selector Valves	CHECK ON
☐ Fuel Boost Pumps	OFF OR LOW AS PER AMBIENT TEMPERATURE
☐ Cowl Flaps	AS REQUIRED
☐ Mixture Controls	AS REQUIRED BY FIELD ELEVATION
☐ Flaps	APPROACH (15 degrees; when below 152 KIAS) (press F6 and F7 as necessary)
☐ Landing Gear	DOWN (below 152 KIAS)
☐ Flaps	FULL (30 degrees; when below 122 KIAS)
☐ Airspeed	ESTABLISH NORMAL APPROACH SPEED (approx. 95 KIAS)
☐ Propellers	HIGH RPM (press Ctrl+F3 until fully forward)

AFTER LANDING (CLEAR OF RUNWAY)

☐ Landing and Taxi Lights	AS REQUIRED
☐ Flaps	UP (press F6 as necessary)

Trim Tabs	SET TO ZERO (with Num Lock off, press Num Pad 1 and Num Pad 7 as necessary)
☐ Cowl Flaps	OPEN
☐ Fuel Boost Pumps	AS REQUIRED

SHUTDOWN

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Propellers	HIGH RPM (press Ctrl+F3 until fully forward)
☐ Throttles	1,000 RPM (press F2 and F3 as necessary)
☐ Fuel Boost Pumps	OFF
☐ Electrical and Avionics Equipment	OFF
☐ Mixture Controls	IDLE CUT-OFF (press Ctrl+Shift+F2 until fully back)
☐ Magneto/Start Switches	OFF AFTER ENGINES STOP (press M+Minus key to L, R, OFF)
☐ Battery and Alternator Switches	OFF AFTER ENGINES STOP

Beechcraft King Air 350

BEFORE ENGINE STARTING

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Landing Gear Control	CHECK DOWN
☐ Power Levers	IDLE (press F2 until Idle)
☐ Propeller Controls	FULL FORWARD (press Ctrl+F3 until fully in)
☐ Condition Levers	FUEL CUTOFF (press Ctrl+Shift+F2 until fully out)
☐ Fuel Quantity	CHECK
☐ Anti-ice	ON
☐ Beacon	ON
☐ Anti-ice Annunciators	ILLUMINATED (press Shift+5 to display annunciator panel)

ENGINE STARTING (BATTERY)

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Battery Switch	ON
☐ Beacon	ON
☐ Propeller Area	CLEAR
☐ Fuel Flow	ON (press Ctrl+Shift+F4)
☐ Right Ignition and Engine Start Switch	ON (click and hold until engine starts)
☐ Right Condition Lever	LOW IDLE (after the N1 Turbine rpm has stabilized, 12% minimum)
☐ Right ITT and N1 Turbine RPM	MONITOR
☐ R FUEL PRESS LO Annunciator	EXTINGUISHED
☐ R OIL PRESS LO Annunciator	EXTINGUISHED
☐ Right Oil Pressure	CHECK
☐ Right Condition Lever	HIGH IDLE
☐ Right Generator	ON
☐ Left Ignition and Engine Start Switch	ON (Click and hold until engine starts)
☐ Left Condition Lever	LOW IDLE (after the N1 Turbine rpm has stabilized, 12% minimum)
☐ Left ITT and N1 Turbine RPM	MONITOR
☐ L FUEL PRESS LO Annunciator	EXTINGUISHED
☐ L OIL PRESS LO Annunciator	EXTINGUISHED
☐ Left Oil Pressure	CHECK
☐ Left Condition Lever	HIGH IDLE
☐ Right Condition Lever	REDUCE TO LOW IDLE
☐ Left Generator	ON
☐ Avionics Master Switch	ON

BEFORE TAKEOFF (RUNUP)

☐ Avionics	CHECK
☐ Autopilot	CHECK
☐ Electronic Pitch Trim Control	CHECK
☐ Trim Tabs	SET (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Primary Governors	EXERCISE AT 1,500 RPM
☐ Autofeather	ARM
☐ Manual Propeller Feathering	CHECK
☐ Anti-ice	AS REQUIRED
☐ Fuel Quantity, Flight, and Engine Instruments	CHECK

BEFORE TAKEOFF (FINAL ITEMS)

☐ Annunciator Lights	EXTINGUISHED OR CONSIDERED
☐ Transponder	ON ALT
☐ Lights	AS REQUIRED
☐ Anti-ice	AS REQUIRED
☐ Takeoff Speeds (V1, VR, and V2)	CONFIRM

TAKEOFF

☐ Brakes	HOLD
☐ Power Levers	100% N1 TURBINE RPM (observe ITT limits) (press F3 as necessary)
☐ Brakes	RELEASE (press Period key)
☐ VR	ROTATE TO APPROX. 10 DEGREES PITCH UP
☐ Landing Gear	UP (when positive climb established) (press G)
☐ Airspeed	MAINTAIN V2 UNTIL CLEAR OF OBSTACLES

☐ Flaps	UP (BLUE LINE, 125 KIAS MINIMUM)

CLIMB

☐ Climb Power	90% N1 TURBINE RPM (or as desired) (press F2 or F3 as necessary)
☐ Propellers	1,600 RPM (or as desired) (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Propeller Synchrophaser	ON
☐ Engine Instruments	MONITOR
☐ Lights	AS REQUIRED

CRUISE

☐ Cruise Power	AS DESIRED (press F2 or F3 as necessary)
☐ Engine Instruments	MONITOR
☐ Autofeather	OFF

DESCENT

☐ Altimeter	SET
☐ Autofeather	ARM
☐ Fuel Balance	CHECK
☐ Power	AS REQUIRED (press F2 or F3 as necessary)

BEFORE LANDING

☐ Autofeather	VERIFY ARMED
☐ VREF	CONFIRM
☐ Altimeter	SET
☐ Flaps	APPROACH (press F7 until APPR)
☐ Landing Gear	DOWN (press G)
☐ Lights	AS REQUIRED
☐ Anti-ice	AS REQUIRED

NORMAL LANDING—WHEN LANDING IS ASSURED

☐ Flaps	DOWN (press F7 until DN)
☐ Airspeed	VREF
☐ Condition Levers	HIGH IDLE (press Ctrl+Shift+F3 until fully in)
☐ Propeller Levers	FULL FORWARD (press Ctrl+F3 until fully in)
☐ Power Levers	IDLE (press F2 until Idle)

--AFTER TOUCHDOWN--

☐ Power Levers	GROUND FINE (press F2 until fully out)
☐ Brakes	AS REQUIRED (press Period key)

AFTER LANDING

☐ Engine Auto-Ignition	OFF
☐ Anti-ice	OFF
☐ Lights	AS REQUIRED
☐ Transponder	STANDBY (press Shift+2 to display radio stack)
☐ Trim Tabs	SET (with Num Lock off press Num Pad 1 or Num Pad 7 as necessary)
☐ Flaps	UP (press F6 until UP)

SHUTDOWN AND SECURING

☐ Parking Brake	SET (press Shift+Period key)
☐ Avionics Master	OFF
☐ Autofeather	OFF
☐ Lights	OFF
☐ ITT	STABILIZED AT MINIMUM TEMPERATURE FOR 1 MINUTE
☐ Condition Levers	FUEL CUTOFF (press Ctrl+Shift+F2 until fully out)
☐ Propellers	FEATHER (press Ctrl+F2 until fully out)
☐ Battery and Generator Switches	OFF (below 15% N1)

Bell 206B JetRanger

BEFORE TAKEOFF

☐ Fuel Quantity	CHECK
☐ Engine and Transmission Instruments	CHECK WITHIN LIMITS
☐ Lights	AS REQUIRED
☐ Radios and Avionics	SET
☐ Throttle	FULL OPEN (press Ctrl+F3 as necessary)
☐ Power and Flight Instruments	SET and CHECK
☐ Power Turbine (N2)	SET FOR 100% in flat pitch

TAKEOFF

☐ Collective Pitch	INCREASE TO HOVER (press F3 as necessary)
☐ Engine Instruments	CHECK
☐ Directional Control	AS REQUIRED to maintain desired heading
☐ Cyclic Control	AS REQUIRED to accelerate smoothly
☐ Collective	AS REQUIRED for desired climb rate and airspeed

IN-FLIGHT OPERATIONS

☐ Airspeed	AS DESIRED (below 130 KIAS)
☐ Engine Instruments	CHECK

☐ Fuel Quantity	CHECK
☐ Altimeter	SET and CHECK

DESCENT AND LANDING

☐ Throttle	FULLY OPEN (press Ctrl+F3 as necessary)
☐ Power Turbine RPM (N2)	97-100%
☐ Flight Path	AS REQUIRED
☐ LDG LTS Switch	ON AS REQUIRED

Boeing 737-400

PUSHBACK (IF PARKED AT A GATE)

☐ Pushback	REQUEST (press Shift+P, then 1 for tail-left or 2 for tail-right, then press Shift+P to stop)

BEFORE START

☐ Parking Brake	SET (press Ctrl+Period key)

ENGINE START

Press Ctrl+E to initiate engine autostart sequence.

AFTER START

☐ Engine Start Switches	CHECK GEN
☐ Pitot Heat	ON
☐ De-ice	AS REQUIRED
☐ Engine Start Levers	CHECK IDLE
☐ Lights	AS REQUIRED
☐ Autopilot	SET and OFF
☐ Instruments	CHECKED
☐ Autobrake Switch	RTO (Rejected Takeoff)
☐ Avionics Switch	ON
☐ Avionics	SET (press Shift+2 to display radio stack)

DURING TAXI/BEFORE TAKEOFF

☐ Brakes	RELEASE (press Period key)
☐ Thrust Levers	INCREASE SLIGHTLY TO ROLL (press F3 or F2 as necessary)
☐ Thrust Levers	IDLE FOR TAXI (press F2 or F3 as necessary)
☐ Flight Controls	CHECK
☐ Flaps	SET FOR TAKEOFF (5) (press F7 as necessary)
☐ Brakes	SET (press Period key)

CLEARED FOR TAKEOFF

☐ Engine Start Switches	GEN
☐ Flight Director	ON
☐ Autothrottle	ARM (if using TO/GA mode for takeoff)
☐ Transponder	ON (press Shift+2 to display radio stack)
☐ Lights	AS REQUIRED

TAKEOFF

☐ Brakes	RELEASE (press Period key)
☐ Thrust Levers	ADVANCE SMOOTHLY TO 40% N1 (press F2 or F3 as necessary)

--WAIT FOR ENGINE STABILIZATION--

☐ Thrust Levers	ADVANCE SMOOTHLY TO 100% N1 (press F2 or F3 as necessary)

--OR--

☐ TO/GA Mode	ENGAGE (press Ctrl+Shift+R)
☐ Engine Instruments	MONITOR
☐ Airspeed 80 KIAS	CALLOUT “80 KNOTS”

-- VERIFY PROPER THRUST SET--

☐ Airspeed V1	CALLOUT “V1”
☐ Airspeed VR	CALLOUT “ROTATE”

--ROTATE TO APPROX. 10 DEGREES PITCH UP--

☐ Airspeed V2	CALLOUT “V2”
☐ Landing Gear	UP (when positive climb established) (press G)
☐ Airspeed	MAINTAIN V2+20 KIAS
☐ Autopilot	ENGAGE AT 1,000 ft AGL
☐ Flaps	RETRACT TO 1 AT 1,000 ft AGL (press F6 until 1)
☐ Flaps	UP AT 210 KIAS (press F6 until Up)
☐ Autothrottle	OFF
☐ Thrust Levers	90% N1 (press F2 or F3 as necessary)
☐ Airspeed	250 KIAS AT 3,000 ft AGL
☐ Landing Gear Lever	Verify OFF

CLIMB

☐ Airspeed	MAINTAIN 250 KIAS
☐ Landing Lights	OFF ABOVE 10,000 ft MSL
☐ Airspeed	280 KIAS ABOVE 10,000 ft MSL
☐ Altimeter	SET TO 29.92 CROSSING 18,000 ft MSL

CRUISE

☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Trim	AS NECESSARY (press Num Pad 1 or Num Pad 7 as necessary)

DESCENT

☐ Autobrake Switch	AS DESIRED
☐ Airspeeds (VREF, VAPP)	COMPUTED and SET (see the Reference page of the Kneeboard)
☐ De-ice	AS REQUIRED
☐ Autopilot	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Altimeter	SET TO LOCAL SETTING CROSSING 18,000 ft MSL
☐ Avionics	SET
☐ Airspeed	<250 KIAS BELOW 10,000 ft MSL
☐ Landing Lights	ON BELOW 10,000 ft MSL
☐ Approach Procedure	REVIEW

APPROACH

☐ Airspeed	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Flaps	AS DESIRED (press F7 as necessary)
☐ Autopilot	AS DESIRED
☐ Autothrottle	ARM (if using TO/GA mode for go-around)

LANDING

☐ Airspeed	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Speedbrake	ARMED (press Shift + / [forward slash key])
☐ Landing Gear	DOWN AND CONFIRMED (press G)
☐ Flaps	AS DESIRED (press F7 as necessary)
☐ Start Switches	GEN
☐ Autopilot	AS DESIRED

LANDING ROLL

☐ Thrust Levers	IDLE (press F2 or F3 as necessary)
☐ Autopilot	CHECK DISENGAGED
☐ Autothrottle	CHECK OFF
☐ Speedbrake Lever	CHECK FULL UP (press Shift+/ [forward slash key] if necessary)
☐ Brake	AS NECESSARY (press Period key)
☐ Thrust Levers	REVERSE (press F2 until Reverse)
☐ Thrust Levers	IDLE AT 60 KIAS (press F3 until Idle)

TAXI-IN

☐ Speedbrake Lever	DN (press / [forward slash key])
☐ Flap Lever	UP (press F6 until Up)
☐ Pitot Heat	OFF
☐ Engine Start Switches	AS DESIRED
☐ Landing Lights	AS DESIRED
☐ Flight Director	OFF
☐ Transponder	AS REQUIRED

PARKING

☐ Parking Brake	SET (press Ctrl+Period)
☐ Start Levers	CUTOFF (press Ctrl+Shift+F1)
☐ De-ice	OFF
☐ Lights	AS REQUIRED
☐ Speedbrake Lever	DOWN (press / [forward slash key] if necessary)
☐ Transponder	AS REQUIRED

Boeing 747-400

PUSHBACK (IF PARKED AT A GATE)

☐ Pushback	REQUEST (press Shift+P, then 1 for tail-left or 2 for tail-right, then press Shift+P to stop)

BEFORE START

☐ Parking Brake	SET (press Ctrl+Period key)

ENGINE START

Press Ctrl+E to initiate engine autostart sequence.

AFTER START

☐ De-ice	AS REQUIRED
☐ Flight Controls	CHECK
☐ Autopilot	SET AND OFF
☐ Instruments	CHECKED
☐ Autobrake	RTO (REJECTED TAKEOFF)
☐ Avionics Switch	ON
☐ Avionics	SET (press Shift+2 to display radio stack)
☐ Trim	SET
☐ Beacon Light Switch	ON

BEFORE TAKEOFF

☐ Flaps	SET FOR TAKEOFF (press F7 as necessary)
☐ Flight Director	ON
☐ Autothrottle	ARM (if using TO/GA mode for takeoff)

TAKEOFF

☐ Brakes	RELEASE (press Period key)
☐ Strobe Lights	ON
☐ Transponder	ALT (press Shift+2 to display radio stack)
☐ Thrust Levers	ADVANCE TO 1.05 EPR (press F2 or F3 as necessary)
☐ Thrust Levers	ADVANCE SMOOTHLY TO 100% N1 (press F2 or F3 as necessary)

--OR--

☐ TO/GA Mode	ENGAGE (press Ctrl+Shift+R)
☐ Thrust	VERIFY CORRECT FOR TAKEOFF
☐ Airspeed 80 KIAS	CALLOUT "80 KNOTS"
☐ Airspeed V1	CALLOUT "V1"
☐ Airspeed VR	CALLOUT "ROTATE"

--ROTATE TO APPROX. 10 DEGREES PITCH UP--

☐ Airspeed V2	CALLOUT "V2"
☐ Landing Gear	UP (when positive climb established) (press G)
☐ Autopilot Heading Select Switch	ON IF DESIRED
☐ Airspeed	MAINTAIN V2+15 KIAS
☐ Autopilot	ENGAGE
☐ Flaps	START RETRACT ON SCHEDULE AT 1,000 ft AGL (press F6 as necessary)

CLIMB

☐ Autothrottle	OFF
☐ Landing Lights	OFF ABOVE 10,000 ft MSL
☐ Altimeter	SET TO 29.92 CROSSING 18,000 ft MSL

CRUISE

☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Trim	AS NECESSARY (press Num Pad 6 or Num Pad 7 as necessary)

DESCENT

☐ Airspeeds (VREF, VAPP)	COMPUTED AND SET (see the Reference page of the Kneeboard)
☐ Autobrake	AS DESIRED
☐ De-ice	AS REQUIRED
☐ Autopilot	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Altimeter	SET TO LOCAL SETTING CROSSING 18,000 ft MSL
☐ Avionics	SET (press Shift+2 to display radio stack)
☐ Airspeed	<250 KIAS BELOW 10,000 ft MSL
☐ Landing Lights	ON BELOW 10,000 ft MSL
☐ Approach Procedure	REVIEW

APPROACH

☐ Airspeed	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Flaps	AS DESIRED (press F7 as necessary)
☐ Autopilot	AS DESIRED

LANDING

☐ Airspeed	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Landing Gear	DOWN and CONFIRMED (press G)
☐ Flaps	AS DESIRED (press F7 as necessary)
☐ Speedbrake	ARMED (press Shift + / [forward slash key])
☐ Autopilot	AS DESIRED
☐ Autothrottle	ARM (if using TO/GA mode for go-around)

LANDING ROLL

☐ Thrust Levers	CLOSED (press F2 or F3 as necessary)
☐ Autothrottle	CHECK OFF
☐ Speedbrake Lever	CHECK FULL UP (press Shift+/ [forward slash key] if necessary)
☐ Thrust Levers	REVERSE (press F2 until Reverse)
☐ Thrust Levers	IDLE AT 60 KIAS (press F3 until Idle)
☐ Autobrake	OFF
☐ Brake	AS NECESSARY (press Period key)
☐ Autopilot	CHECK DISENGAGED

TAXI-IN

☐ Speedbrake Lever	DOWN (press / [forward slash key])
☐ Lights	AS DESIRED
☐ Flap Lever	UP (press F6 until Up)
☐ Transponder	STBY

PARKING

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Fuel Control Switches	CUTOFF (press Ctrl+Shift+F1)

☐ De-ice	OFF
☐ Lights	AS REQUIRED
☐ Flight Director	OFF

Boeing 777-300

PUSHBACK (IF PARKED AT A GATE)	
☐ Pushback	REQUEST (press Shift+P, then 1 for tail-left or 2 for tail-right, then press Shift+P to stop)

BEFORE START	
☐ Parking Brake	SET (press Ctrl+Period key)

ENGINE START
Press Ctrl+E to initiate engine autostart sequence.

AFTER START	
☐ De-ice	AS REQUIRED
☐ Flight Controls	CHECK
☐ Autopilot	SET AND OFF
☐ Instruments	CHECKED
☐ Autobrake	RTO (REJECTED TAKEOFF)
☐ Avionics Switch	ON
☐ Avionics	SET (press Shift+2 to display radio stack)
☐ Trim	SET
☐ Beacon Light Switch	ON

BEFORE TAKEOFF	
☐ Flaps	SET FOR TAKEOFF (press F7 as necessary)
☐ Flight Director	ON
☐ Autothrottle	ARM (if using TO/GA mode for takeoff)

TAKEOFF	
☐ Brakes	RELEASE (press Period key)
☐ Strobe Lights	ON
☐ Transponder	ALT (press Shift+2 to display radio stack)
☐ Thrust Levers	ADVANCE TO 1.05 EPR (press F2 or F3 as necessary)
☐ Thrust Levers	ADVANCE SMOOTHLY TO 100% N1 (press F2 or F3 as necessary)

--OR--	
☐ TO/GA Mode	ENGAGE (press Ctrl+Shift+R)
☐ Thrust	VERIFY CORRECT FOR TAKEOFF
☐ Airspeed 80 KIAS	CALLOUT "80 KNOTS"
☐ Airspeed V1	CALLOUT "V1"
☐ Airspeed VR	CALLOUT "ROTATE"

-- ROTATE TO APPROX. 10 DEGREES PITCH UP--	
☐ Airspeed V2	CALLOUT "V2"
☐ Landing Gear	UP (when positive climb established) (press G)
☐ Autopilot Heading Select switch	ON IF DESIRED
☐ Airspeed	MAINTAIN V2+15 KIAS
☐ Autopilot	ENGAGE
☐ Flaps	START RETRACT ON SCHEDULE AT 1,000 ft AGL (press F6 as necessary)

CLIMB	
☐ Autothrottle	OFF
☐ Landing Lights	OFF ABOVE 10,000 ft MSL
☐ Altimeter	SET TO 29.92 CROSSING 18,000 ft MSL

CRUISE	
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Trim	AS NECESSARY (press Num Pad 6 or Num Pad 7 as necessary)

DESCENT	
☐ Airspeeds (VREF, VAPP)	COMPUTED AND SET (see the Reference page of the Kneeboard)
☐ Autobrake	AS DESIRED
☐ De-ice	AS REQUIRED
☐ Autopilot	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Altimeter	SET TO LOCAL SETTING CROSSING 18,000 ft MSL
☐ Avionics	SET (press Shift+2 to display radio stack)
☐ Airspeed	<250 KIAS BELOW 10,000 ft MSL
☐ Landing Lights	ON BELOW 10,000 ft MSL
☐ Approach Procedure	REVIEW

APPROACH	
☐ Airspeed	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Flaps	AS DESIRED (press F7 as necessary)
☐ Autopilot	AS DESIRED

LANDING

☐ Airspeed	AS DESIRED
☐ Thrust Levers	AS DESIRED (press F2 or F3 as necessary)
☐ Landing Gear	DOWN and CONFIRMED (press G)
☐ Flaps	AS DESIRED (press F7 as necessary)
☐ Speedbrake	ARMED (press Shift + / [forward slash key])
☐ Autopilot	AS DESIRED
☐ Autothrottle	ARM (if using TO/GA mode for go-around)

LANDING ROLL

☐ Thrust Levers	CLOSED (press F2 or F3 as necessary)
☐ Autothrottle	CHECK OFF
☐ Speedbrake Lever	CHECK FULL UP (press Shift+/ [forward slash key] if necessary)
☐ Thrust Levers	REVERSE (press F2 until Reverse)
☐ Thrust Levers	IDLE AT 60 KIAS (press F3 until Idle)
☐ Autobrake	OFF
☐ Brake	AS NECESSARY (press Period key)
☐ Autopilot	CHECK DISENGAGED

TAXI-IN

☐ Speedbrake Lever	DOWN (press / [forward slash key])
☐ Lights	AS DESIRED
☐ Flap Lever	UP (press F6 until Up)
☐ Transponder	STBY

PARKING

☐ Parking Brake	SET (press Ctrl+Period key
☐ Fuel Control Switches	CUTOFF (press Ctrl+Shift+F1)
☐ De-ice	OFF
☐ Lights	AS REQUIRED
☐ Flight Director	OFF

Cessna C172SP Skyhawk

BEFORE STARTING ENGINE

☐ Brakes	TEST AND SET (press Ctrl+Period key)
☐ Electrical Equipment, Autopilot	OFF
☐ Avionics Master Switch	OFF
☐ Fuel Selector Valve	BOTH

ENGINE START

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Throttle	OPEN 1/4 INCH (press F3 or F2 as necessary)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Propeller Area	CLEAR
☐ Master Switch	ON
☐ Auxiliary Fuel Pump Switch	ON
☐ Ignition Switch	START (release when engine starts) (press M+Plus key to R, L, Both, Start)

Then:

☐ Oil Pressure	CHECK
☐ Auxiliary Fuel Pump	OFF
☐ Flashing Beacon and Nav Lights	ON as required
☐ Avionics Master Switch	ON
☐ Flaps	RETRACT (press F6 until Up)

BEFORE TAKEOFF

☐ Parking Brake	SET (press Ctrl+Period)
☐ Flight Controls	FREE AND CORRECT
☐ Flight Instruments	CHECK and SET
☐ Fuel Quantity	CHECK
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Fuel Selector Valve	RECHECK BOTH
☐ Elevator Trim	SET for takeoff (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Throttle	1,800 RPM (press F3 or F2 as necessary)
☐ Magnetos	CHECK <150 rpm drop on each; <50 rpm drop between (press M+Minus key, then press M+Plus key to L, R, L, Both)
☐ Suction Gauge	CHECK
☐ Engine Instruments and Ammeter	CHECK
☐ Annunciator Panel	CHECK (press Shift+4 to display window)
☐ Throttle	1,000 RPM or less (press F2 or F3 as necessary)
☐ Strobe Lights	AS DESIRED
☐ Radios and Avionics	SET (press Shift+2 to display radio stack)
☐ Autopilot	OFF
☐ Wing Flaps	SET for takeoff (0-10 degrees) (press F7 or F6 as necessary)
☐ Brakes	RELEASE (press Period key)

TAKEOFF

☐ Wing Flaps	0-10 degrees (press F7 or F6 as necessary)
☐ Throttle	FULL OPEN (press F3 until fully in)
☐ Mixture	RICH (above 3000 feet, LEAN to obtain maximum rpm) (press Ctrl+Shift+F3 or Ctrl+Shift+F2 as necessary)
☐ Elevator Control	LIFT NOSE WHEEL (at 55 KIAS)
☐ Climb Speed	70-80 KIAS

EN ROUTE CLIMB

☐ Airspeed	70-85 KIAS
☐ Throttle	FULL OPEN (press F3 as necessary)
☐ Mixture	RICH (above 3000 feet, LEAN to obtain maximum rpm) (press Ctrl+Shift+F3 or Ctrl+Shift+F2 as necessary)

CRUISE

☐ Power	2,100-2,700 RPM (press F2 or F3 as necessary)
☐ Elevator Trim	ADJUST (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Mixture	LEAN (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)

DESCENT

☐ Power	AS DESIRED (press F2 or F3 as necessary)
☐ Mixture	ADJUST for smooth operation (Full Rich for idle power) (press Ctrl+Shift+F3 as necessary)
☐ Fuel Selector Valve	BOTH

BEFORE LANDING

☐ Fuel Selector Valve	BOTH
☐ Mixture	RICH (press Ctrl+Shift+F3 as necessary)
☐ Landing/Taxi Lights	ON
☐ Autopilot	OFF (press Shift+2 to display radio stack)

LANDING

☐ Airspeed	65-75 KIAS (flaps UP)
☐ Wing Flaps	AS DESIRED 0-10 degrees <110 KIAS 10-30 degrees <85 KIAS (press F6 or F7 as necessary)
☐ Airspeed	60-70 KIAS (flaps DOWN)
☐ Touchdown	MAIN WHEELS FIRST
☐ Landing Roll	LOWER NOSE WHEEL GENTLY
☐ Braking	MINIMUM REQUIRED (press Period key)

AFTER LANDING

☐ Wing Flaps	UP (press F6 as necessary)

SECURING AIRPLANE

☐ Parking Brake	SET (press Ctrl+Period)
☐ Avionics Master Switch, Electrical Equipment, Autopilot	OFF
☐ Mixture	IDLE CUT OFF (press Ctrl+Shift+F2 until fully out)
☐ Ignition Switch	OFF (press M+Minus key until Off)
☐ Master Switch	OFF
☐ Fuel Selector Valve	LEFT or RIGHT to prevent cross-feeding

Cessna C182S Skylane

BEFORE STARTING ENGINE

☐ Brakes	TEST and SET (press Ctrl+Period key)
☐ Electrical Equipment	OFF
☐ Avionics Power Switch	OFF
☐ Cowl Flaps	OPEN
☐ Fuel Selector Valve	BOTH

ENGINE START

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Throttle	OPEN 1/4-INCH (press F3 or F2 as necessary)
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Propeller Area	CLEAR
☐ Master Switch	ON
☐ Auxiliary Fuel Pump Switch	ON
☐ Ignition Switch	START (release when engine starts) (press M+Plus key to R, L, Both, Start)

Then:

☐ Oil Pressure	CHECK
☐ Auxiliary Fuel Pump	OFF
☐ Flashing Beacon and Nav Lights	ON as required
☐ Avionics Power Switch	ON
☐ Flaps	RETRACT (press F6 until UP)

BEFORE TAKEOFF

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Flight Controls	FREE and CORRECT
☐ Flight Instruments	CHECK and SET
☐ Fuel Quantity	CHECK
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Fuel Selector Valve	RECHECK BOTH
☐ Elevator Trim	SET for takeoff (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Rudder Trim	SET for takeoff
☐ Throttle	1,800 RPM (press F3 or F2 as necessary)
☐ Magnetos	CHECK <150 rpm drop on each; <50 rpm drop between (press M+Minus key, then press M+Plus key to L, R, L, Both)
☐ Propeller	CYCLE high rpm/low rpm/high rpm (press Ctrl+F3 until fully in, then press Ctrl+F2 until fully out, then press Ctrl+F3 again until fully in)
☐ Suction Gauge	CHECK
☐ Engine Instruments and Ammeter	CHECK
☐ Annunciator Panel	CHECK (press Shift+4 to display window)
☐ Throttle	800-1,000 RPM (press F2 or F3 as necessary)
☐ Strobe Lights	AS DESIRED
☐ Radios and Avionics	SET
☐ Flaps	SET for takeoff (0-20 degrees) (press F7 or F6 as necessary)
☐ Cowl Flaps	OPEN
☐ Brakes	RELEASE (press Period key)

TAKEOFF

☐ Flaps	0-20 degrees (press F7 or F6 as necessary)
☐ Mixture	RICH (may be leaned if necessary) (press Ctrl+Shift+F3 or Ctrl+Shift+F2 as necessary)
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Throttle	FULL (press F3 until fully in)
☐ Elevator Control	LIFT NOSE WHEEL (at 50-60 KIAS)
☐ Climb Speed	70 KIAS (flaps 20 degrees) 80 KIAS (flaps UP)
☐ Flaps	RETRACT (press F2 as necessary until UP)

NORMAL CLIMB

☐ Airspeed	85-95 KIAS
☐ Throttle	23" MP or FULL (whichever is less) (press F2 or F3 as necessary)
☐ Propeller	2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	15 GPH or FULL RICH (whichever is less) (press Ctrl+Shift+F3 or Ctrl+Shift+F2 as necessary)
☐ Fuel Selector Valve	BOTH
☐ Cowl Flaps	OPEN as required

MAXIMUM PERFORMANCE CLIMB

☐ Airspeed	80 KIAS at sea level to 72 KIAS at 10,000 ft
☐ Throttle	FULL (press F3 until fully in)
☐ Propeller	2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	LEAN (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Cowl Flaps	OPEN
☐ Fuel Selector Valve	BOTH

CRUISE

☐ Throttle	15-23" MP (press F2 or F3 as necessary)
☐ Propeller	2,000-2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Elevator Trim	ADJUST (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Rudder Trim	ADJUST
☐ Mixture	LEAN (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Cowl Flaps	CLOSED

DESCENT

☐ Throttle	AS DESIRED (press F2 or F3 as necessary)
☐ Propeller	AS DESIRED (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	ENRICH as required (press Ctrl+Shift+F3 as necessary)
☐ Cowl Flaps	CLOSED
☐ Fuel Selector Valve	BOTH
☐ Flaps	AS DESIRED 0-10 degrees <140 KIAS 10-20 degrees <120 KIAS FULL <100 KIAS (press F7 as necessary)

BEFORE LANDING

☐ Fuel Selector Valve	BOTH
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Landing/Taxi Lights	ON
☐ Autopilot	OFF (press Shift+2 to display radio stack)

LANDING

☐ Airspeed	70-80 KIAS (flaps UP)
☐ Flaps	AS DESIRED 0-10 degrees <140 KIAS 10-20 degrees <120 KIAS FULL <100 KIAS (press F6 or F7 as necessary)
☐ Airspeed	60-70 KIAS (flaps FULL)
☐ Trim	ADJUST as desired (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Touchdown	MAIN WHEELS FIRST
☐ Landing Roll	LOWER NOSE WHEEL GENTLY
☐ Braking	MINIMUM REQUIRED (press Period key)

AFTER LANDING

☐ Flaps	UP (press F6 as necessary until UP)
☐ Cowl Flaps	OPEN

SECURING AIRPLANE

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Throttle	IDLE (press F2 as necessary)
☐ Electrical Equipment, Avionics Switch, Autopilot	OFF
☐ Mixture	IDLE CUT-OFF (pulled fully out) (press Ctrl+Shift+F2 as necessary until fully out)
☐ Ignition Switch	OFF (press M+Minus key until Off)
☐ Master Switch	OFF
☐ Fuel Selector Valve	LEFT or RIGHT to prevent cross-feeding

Cessna Caravan C208 Amphibian

BEFORE STARTING ENGINE

☐ Landing Gear Handle	DOWN (on land) or UP (on water) (press G as necessary)
☐ Water Rudders	DOWN for taxiing on water or UP for taxiing on land (press Shift+4 to display throttle quadrant)
☐ Parking Brake	SET (press Ctrl+Period key)
☐ Switches	OFF
☐ Fuel Tank Selector	BOTH
☐ Emergency Power Lever	NORMAL
☐ Power Lever	IDLE (press F2 as necessary)
☐ Propeller Control Lever	MAX (fully forward) (press Ctrl+F3 as necessary)
☐ Fuel Condition Lever	CUTOFF (press Ctrl+Shift+F2 as necessary)
☐ Fuel Shutoff	ON (push in)
☐ Battery Switch	ON
☐ Wing Flaps	UP (press F2 as necessary)

ENGINE START

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Battery Switch	ON
☐ Emergency Power Lever	NORMAL (full aft) position
☐ Propeller Area	CLEAR
☐ Fuel Boost Switch	ON
☐ AUX FUEL PUMP ON Annunciator	ON (press Shift+5 to display annunciator panel)
☐ FUEL PRESS LOW Annunciator	OFF (press Shift+5 to display annunciator panel)
☐ No Fuel Flow	CONFIRM
☐ Starter Switch	START (click switch and hold until engine starts)
☐ IGNITION ON Annunciator	CHECK ON (press Shift+5 to display annunciator panel)
☐ Engine Oil Pressure	CHECK for indication
☐ Ng	STABLE (12% minimum)
☐ Fuel Condition Lever	LOW IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Fuel Flow	CHECK for 80–110 pph
☐ ITT	MONITOR (1,090 degrees C max)
☐ Ng	52% MINIMUM
☐ Starter Switch	OFF (check "STARTER ENERGIZED" annunciator OFF)
☐ Engine Instruments	CHECK
☐ Generator	CHECK "GENERATOR OFF" annunciator OFF
☐ Fuel Boost Switch	NORM (check "AUX FUEL PUMP ON" annunciator OFF)
☐ Avionics Master Switch	ON
☐ Navigation Lights and Flashing Beacon	ON as required
☐ Suction Gauge	CHECK
☐ Radios	AS REQUIRED (press Shift+2 to display radio stack)

TAXIING

☐ Brakes	CHECK
☐ Flight Instruments	CHECK

BEFORE TAKEOFF

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Flight Controls	FREE AND CORRECT
☐ Flight Instruments	CHECK and SET
☐ Fuel Boost Switch	RECHECK NORM
☐ Fuel Tank Selector	RECHECK BOTH
☐ Fuel Quantity	RECHECK
☐ Fuel Shutoff	RECHECK FULLY ON
☐ Elevator Trim Controls	SET for takeoff (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Aileron Trim Controls	SET for takeoff (with Num Lock off, press Num Pad 4 or Num Pad 6 as necessary)
☐ Rudder Trim Controls	SET for takeoff (with Num Lock off, press Num Pad 0 or Num Pad ENTER as necessary)
☐ Power Lever	400 FT-LBS (press F2 or F3 as necessary)
☐ Suction Gauge	CHECK
☐ VOLTAGE LOW annunciator	CHECK OFF
☐ Inertial Separator	CHECK
☐ Engine Instruments	CHECK
☐ Overspeed Governor	CHECK (stabilized at 1,750 +/- 60 rpm)
☐ Power Lever	IDLE (press F2 as necessary)
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Ice Protection	AS REQUIRED
☐ Avionics	CHECK and SET (press Shift+2 to display radio stack)
☐ GPS/NAV Switch	SET
☐ Strobe Lights	AS REQUIRED
☐ Annunciators	EXTINGUISHED or considered
☐ Wing Flaps	SET at 20 degrees (press F7 or F6 as necessary)
☐ Brakes	RELEASE (press Period key)
☐ Fuel Condition Lever	HIGH IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)

TAKEOFF ON WATER

☐ Landing Gear	UP (press G if necessary)
☐ Landing Gear Blue Indicator Lights	CHECK ILLUMINATED
☐ Wing Flaps	0-20 degrees (20 degrees recommended) (press F7 or F6 as necessary)
☐ Rudder Trim	SET
☐ Control Wheel	HOLD AFT
☐ Power	SET FOR TAKEOFF (1,900 rpm) (press F3 or F2 as necessary)
☐ Annunciators	CHECK
☐ Water Rudders	UP
☐ Control Wheel	APPLY LIGHT BACK-PRESSURE to lift off.
☐ Climb Speed	85-95 KIAS (with obstacles ahead, climb at 80 KIAS)
☐ Wing Flaps	RETRACT after reaching 90 KIAS

TAKEOFF ON LAND

☐ Water Rudders	UP
☐ Wing Flaps	10-20 degrees (20 degrees for short field) (press F7 or F6 as necessary)
☐ Power	SET FOR TAKEOFF (1,900 rpm) (press F3 or F2 as necessary)
☐ Annunciators	CHECK
☐ Rotate	65-70 KIAS
☐ Climb Speed	80-95 KIAS (with obstacles ahead, climb at 80 KIAS)
☐ Wing Flaps	RETRACT after reaching 90 KIAS
☐ Landing Gear	RETRACT (press G)

CRUISE CLIMB

☐ Ice Protection	AS REQUIRED
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Airspeed	110-120 KIAS
☐ Propeller	1,600-1,900 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Torque	AS DESIRED

MAXIMUM PERFORMANCE CLIMB

☐ Ice Protection	AS REQUIRED
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Airspeed	104 KIAS (sea level to 10,000 feet MSL) 87 KIAS (20,000 feet MSL)
☐ Propeller	1,900 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Torque	AS DESIRED (1,865 FT-LBS MAXIMUM)

CRUISE

☐ Ice Protection	AS REQUIRED
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Propeller	1,600-1,900 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Power	AS DESIRED (press F2 or F3 as necessary)

BEFORE LANDING ON WATER

☐ Landing Gear	UP (press G if necessary)
☐ Landing Gear Blue Indicator Lights	CHECK ILLUMINATED
☐ Water Rudders	UP (press Shift+4 to display throttle quadrant)
☐ Fuel Selector	BOTH
☐ Fuel Condition Lever	HIGH IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Propeller Control Lever	MAX (fully forward) (press Ctrl+F3 as necessary)
☐ Autopilot	OFF
☐ Wing Flaps	AS DESIRED (flaps down preferred) 0-10 degrees <175 KIAS 10-20 degrees <150 KIAS 20-30 degrees <125 KIAS (press F7 as necessary)
☐ Airspeed	75-85 KIAS (flaps FULL DOWN)

BEFORE LANDING ON LAND

☐ Landing Gear	UP (press G if necessary)
☐ Landing Gear Amber Indicator Lights	CHECK ILLUMINATED
☐ Water Rudders	UP (press Shift+4 to display throttle quadrant)
☐ Fuel Selector	BOTH
☐ Fuel Condition Lever	HIGH IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Propeller Control Lever	MAX (full forward) (press Ctrl+F3 as necessary)
☐ Autopilot	OFF
☐ Wing Flaps	AS DESIRED (flaps down preferred) 0-10 degrees <175 KIAS 10-20 degrees <150 KIAS 20-30 degrees <125 KIAS (press F7 as necessary)
☐ Airspeed	75-85 KIAS (flaps FULL DOWN)

LANDING ON WATER

☐ Wing Flaps	FULL DOWN (press F7 until DOWN)
☐ Airspeed	75-85 KIAS
☐ Touchdown	SLIGHTLY TAIL LOW
☐ Control Wheel	HOLD AFT as amphibian decelerates to taxi speed
☐ Power Lever	BETA range after TOUCHDOWN, if desired, for faster deceleration (press F2 as necessary)

LANDING ON LAND

☐ Wing Flaps	FULL DOWN (press F7 until DOWN)
☐ Airspeed	75-85 KIAS
☐ Touchdown	SLIGHTLY TAIL LOW
☐ Control Wheel	EASE FORWARD to lower bow wheels gently to runway.
☐ Power Lever	BETA range after TOUCHDOWN (press F2 as necessary)
☐ Braking	MINIMUM REQUIRED (press Period key)

BALKED LANDING (GO-AROUND)

☐ Power Lever	ADVANCE for takeoff power (1,900 rpm) (press F3 as necessary)
☐ Wing Flaps	RETRACT to 20 degrees (press F6 as necessary)
☐ Climb Speed	80 KIAS MINIMUM until obstacles are cleared
☐ Wing Flaps	RETRACT after reaching safe altitude and airspeed (press F6 as necessary)

AFTER LANDING

☐ Water Rudders	DOWN (except on land) (press Shift+4 to display throttle quadrant)
☐ Fuel Condition Lever	LOW IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Wing Flaps	UP (press F6 as necessary until UP)
☐ Ice Protection Equipment	OFF
☐ Strobe Lights	OFF
☐ Landing and Taxi Lights	AS REQUIRED
☐ Fuel Condition Lever	LOW IDLE when clear of the runway (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)

SHUTDOWN AND SECURING AIRPLANE

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Avionics Switches	OFF
☐ Fuel Boost Switch	OFF
☐ Power Lever	IDLE (press F2 or F3 as necessary)
☐ ITT	STABILIZED at minimum temperature for one minute
☐ Propeller Control Lever	FEATHER (press Ctrl+F2 or Ctrl+F3 as necessary)

☐ Fuel Condition Lever	CUTOFF (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Lighting Switches	OFF
☐ Battery Switch	OFF
☐ Fuel Tank Selector	LEFT OFF or RIGHT OFF

Cessna Grand Caravan C208B

BEFORE STARTING ENGINE

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Switches	OFF
☐ Fuel Tank Selector	BOTH
☐ Emergency Power Lever	NORMAL
☐ Power Lever	IDLE (press F2 as necessary)
☐ Propeller Control Lever	MAX (fully forward) (press Ctrl+F3 as necessary)
☐ Fuel Condition Lever	CUTOFF (press Ctrl+Shift+F2 as necessary)
☐ Fuel Shutoff	ON (push in)
☐ Battery Switch	ON
☐ Wing Flaps	UP (press F2 as necessary)

ENGINE START

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Battery Switch	ON
☐ Emergency Power Lever	NORMAL (full aft) position
☐ Propeller Area	CLEAR
☐ Fuel Boost Switch	ON
☐ AUX FUEL PUMP ON Annunciator	ON (press Shift+5 to display annunciator panel)
☐ FUEL PRESS LOW Annunciator	OFF (press Shift+5 to display annunciator panel)
☐ No Fuel Flow	CONFIRM
☐ Starter Switch	START (click switch and hold until engine starts)
☐ IGNITION ON Annunciator	CHECK ON (press Shift+5 to display annunciator panel)
☐ Engine Oil Pressure	CHECK for indication
☐ Ng	STABLE (12% minimum)
☐ Fuel Condition Lever	LOW IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Fuel Flow	CHECK for 80–110 pph
☐ ITT	MONITOR (1,090 degrees C max)
☐ Ng	52% MINIMUM
☐ Starter Switch	OFF (check "STARTER ENERGIZED" annunciator OFF)
☐ Engine Instruments	CHECK
☐ Generator	CHECK "GENERATOR OFF" annunciator OFF
☐ Fuel Boost Switch	NORM (check "AUX FUEL PUMP ON" annunciator OFF)
☐ Avionics Master Switch	ON
☐ Navigation Lights and Flashing Beacon	ON as required
☐ Suction Gauge	CHECK
☐ Radios	AS REQUIRED (press Shift+2 to display radio stack)

TAXIING

☐ Brakes	CHECK
☐ Flight Instruments	CHECK

BEFORE TAKEOFF

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Flight Controls	FREE AND CORRECT
☐ Flight Instruments	CHECK and SET
☐ Fuel Boost Switch	RECHECK NORM
☐ Fuel Tank Selector	RECHECK BOTH
☐ Fuel Quantity	RECHECK
☐ Fuel Shutoff	RECHECK FULLY ON
☐ Elevator Trim Controls	SET for takeoff (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Aileron Trim Controls	SET for takeoff (with Num Lock off, press Num Pad 4 or Num Pad 6 as necessary)
☐ Rudder Trim Controls	SET for takeoff (with Num Lock off, press Num Pad 0 or Num Pad ENTER as necessary)
☐ Power Lever	400 FT-LBS (press F2 or F3 as necessary)
☐ Suction Gauge	CHECK
☐ VOLTAGE LOW Annunciator	CHECK OFF
☐ Inertial Separator	CHECK
☐ Engine Instruments	CHECK
☐ Overspeed Governor	CHECK (stabilized at 1,750 +/- 60 rpm)
☐ Power Lever	IDLE (press F2 as necessary)
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Ice Protection	AS REQUIRED
☐ Avionics	CHECK and SET (press Shift+2 to display radio stack)
☐ GPS/NAV Switch	SET
☐ Strobe Lights	AS REQUIRED
☐ Annunciators	EXTINGUISHED or considered
☐ Wing Flaps	SET at 20 degrees (press F7 or F6 as necessary)

☐ Brakes	RELEASE (press Period key)
☐ Fuel Condition Lever	HIGH IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)

TAKEOFF

☐ Wing Flaps	20 degrees (press F7 or F6 as necessary)
☐ Power	SET FOR TAKEOFF (1,900 rpm) (press F3 or F2 as necessary)
☐ Annunciators	CHECK
☐ Rotate	70-75 KIAS
☐ Climb Speed	85-95 KIAS
☐ Wing Flaps	RETRACT to 10 degrees after reaching 85 KIAS and 0 degrees after reaching 95 KIAS

CRUISE CLIMB

☐ Ice Protection	AS REQUIRED
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Airspeed	110-120 KIAS
☐ Propeller	1,600-1,900 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Torque	AS DESIRED

MAXIMUM PERFORMANCE CLIMB

☐ Ice Protection	AS REQUIRED
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Airspeed	104 KIAS (sea level to 10,000 feet MSL) 87 KIAS (20,000 feet MSL)
☐ Propeller	1,900 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Torque	AS DESIRED (1,865 ft-lb MAXIMUM)

CRUISE

☐ Ice Protection	AS REQUIRED
☐ Pitot/Static Heat	ON when OAT is below 4 degrees C (40 degrees F)
☐ Propeller	1,600-1,900 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Power	AS DESIRED (press F2 or F3 as necessary)

BEFORE LANDING

☐ Fuel Selector	BOTH
☐ Fuel Condition Lever	HIGH IDLE (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Propeller Control Lever	MAX (full forward) (press Ctrl+F3 as necessary)
☐ Autopilot	OFF
☐ Wing Flaps	AS DESIRED 0-10 degrees <175 KIAS 10-20 degrees <150 KIAS 20-30 degrees <125 KIAS (press F7 as necessary)

NORMAL LANDING

☐ Wing Flaps	FULL DOWN (press F7 until DOWN)
☐ Airspeed	75-85 KIAS
☐ Touchdown	MAIN WHEELS FIRST
☐ Power Lever	BETA range after TOUCHDOWN (press F2 as necessary)
☐ Brakes	AS REQUIRED (press Period key)

SHORT-FIELD LANDING

☐ Wing Flaps	FULL DOWN (press F7 as necessary)
☐ Airspeed	78 KIAS
☐ Power Lever	REDUCE to IDLE after clearing obstacles (press F2 as necessary)
☐ Touchdown	MAIN WHEELS FIRST
☐ Power Lever	BETA range after TOUCHDOWN (press F2 as necessary)
☐ Brakes	APPLY HEAVILY while holding elevator control full aft (press Period key)
☐ Wing Flaps	RETRACT for maximum brake effectiveness at light weights (press F6 as necessary)

BALKED LANDING (GO-AROUND)

☐ Power Lever	ADVANCE for takeoff power (1,900 rpm) (press F3 as necessary)
☐ Wing Flaps	RETRACT to 20 degrees (press F6 as necessary)
☐ Climb Speed	80 KIAS MINIMUM until obstacles are cleared
☐ Wing Flaps	RETRACT after reaching safe altitude and airspeed (press F6 as necessary)

AFTER LANDING

☐ Wing Flaps	UP (press F6 as necessary until UP)
☐ Ice Protection Equipment	OFF
☐ Strobe Lights	OFF
☐ Landing and Taxi Lights	AS REQUIRED

☐ Fuel Condition Lever	LOW IDLE when clear of the runway (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)

SHUTDOWN AND SECURING AIRPLANE

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Avionics Switches	OFF
☐ Fuel Boost Switch	OFF
☐ Power Lever	IDLE (press F2 or F3 as necessary)
☐ ITT	STABILIZED at minimum temperature for one minute
☐ Propeller Control Lever	FEATHER (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Fuel Condition Lever	CUTOFF (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Lighting Switches	OFF
☐ Battery Switch	OFF
☐ Fuel Tank Selector	LEFT OFF or RIGHT OFF

Curtiss JN-4D "Jenny"

STARTING

In the real-world Jenny you'd have to hand-prop the aircraft. In Flight Simulator, press Ctrl+E to initiate engine autostart sequence, or:

☐ Fuel Valve	ON (click with mouse)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Magneto Switch	ON (press M+Plus key)
☐ Start Switch	ENGAGE (press M+Plus key and hold until engine starts)
☐ Oil Pressure	CHECK
☐ Engine Temperature	CHECK

TAKEOFF AND CLIMB

☐ Altimeter	CHECK
☐ Throttle	FULL (press F3 as necessary)
☐ Nose	COMES DOWN
☐ Rotate	WITH AS MUCH GROUNDSPEED AS POSSIBLE
☐ Climb Airspeed	LOW ANGLE, HIGH SPEED

DO NOT TURN before reaching 800 feet AGL.
DO NOT BANK while climbing.

CRUISE

☐ Throttle	1,300 RPM (press F2 and F3 as necessary)
☐ Oil Pressure	MONITOR
☐ Engine Temperature	MONITOR

DESCENT

☐ Altimeter	SET
☐ Fuel Valve	VERIFY ON
☐ Throttle	REDUCE (press F2 as necessary)

LANDING

☐ Throttle	IDLE (on touchdown) (press F2 as necessary)

ENGINE SHUT-DOWN

☐ Throttle	IDLE (press F2 as necessary)
☐ Fuel Valve	OFF (click with mouse)
☐ Magneto Switch	OFF (press M+Minus key)

deHavilland DH-88 Comet

BEFORE STARTING

☐ Wing Flaps	UP AND INDICATING UP (press F6 as necessary)
☐ Landing Gear	DOWN
☐ Parking Brake	SET (press Ctrl+Period key)
☐ Master Battery Switch	ON
☐ Battery Discharge Light	CHECK ON
☐ Generators	ON
☐ Nav Lights	AS REQUIRED
☐ Magnetos	OFF (press M+Minus key until Off)
☐ Carb Heat	COLD (press H to toggle)
☐ Fuel Gauges	CHECKED
☐ Fuel Valves	NORMAL FEED
☐ Fuel Crossfeed	CLOSED
☐ Throttles	CRACKED (press F3 and F2 as necessary)
☐ Mixtures	IDLE CUTOFF (press Ctrl+Shift+F2 until Idle)
☐ Trim	SET
☐ Controls	FREE/Full travel

STARTING

Press Ctrl+E to initiate engine autostart sequence, or:

LEFT ENGINE:

Press E, then 1, to move focus to left engine.

☐ Master Battery Switch	ON
☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until Full Rich)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Magnetos	BOTH ON (press M+Plus key until both on)

☐ Starter Switch	Engage (press M+Plus key and hold until engine starts)
☐ Starter Light	CHECK OFF
☐ Oil Pressure	CHECK
☐ Oil Temperature	CHECK
☐ Suction	CHECK

RIGHT ENGINE:

Press E, then 2, to move focus to right engine.

☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until Full Rich)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Magnetos	BOTH ON (press M+Plus key until both on)
☐ Starter Switch	Engage (press M+Plus key and hold until engine starts)
☐ Starter Light	CHECK OFF
☐ Oil Pressure	CHECK
☐ Oil Temperature	CHECK
☐ Suction	CHECK

Press E, then 1, then 2, to move focus to both engines.

AFTER STARTING

☐ Temps/Press	CHECK
☐ Tail Skid	UNLOCKED FOR TAXI (press Shift+G)

TAXI - WARM UP

☐ Brakes	CHECK (press Period key)
☐ Gyro Instruments	CHECK
☐ Altimeter	CHECK
☐ Flight Instruments	CHECK
☐ Carb Heat	CHECK (press H to toggle)

ENGINE RUN-UP

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Temps & Press	CHECK
☐ Mixtures	FULL RICH (press Ctrl+Shift+F3 until Full Rich)
☐ Throttle	1,500 RPM (press F3 and F2 as necessary)
☐ Generators	CHECK
☐ Heading Indicators	SET
☐ Suction	CHECK
☐ Magneto	CHECK <100 rpm drop on each; <40 rpm drop between (press M+Minus key, then press M+Plus key to L, R, L, Both)
☐ Throttle	1,000 RPM (press F2 and F3 as necessary)

PRE-TAKEOFF

☐ Mixtures	FULL RICH (press Ctrl+Shift+F3 until Full Rich)
☐ Trim	SET
☐ Flight Controls	FREE AND CORRECT
☐ Flaps	POSITION 2 (press F7 and F6 as necessary)
☐ Carb Heat	COLD (press H to toggle)
☐ Tailwheel	LOCKED
☐ Heading Indicator	CHECK

TAKEOFF AND CLIMB (AT SEA LEVEL)

☐ Brakes	RELEASE (press Period key)
☐ Mixtures	FULL RICH (press Ctrl+Shift+F3 until Full Rich)
☐ Throttles	FULL (press F3 as necessary)
☐ Airspeed	DO NOT EXCEED 110 MPH IAS IN INITIAL CLIMB
☐ Landing Gear	WIND UP (when positive rate of climb is established) (press G)
☐ Flaps	RETRACT (press F2 as necessary)

AFTER TAKEOFF AND CLIMB

☐ Landing Gear	VERIFY UP
☐ Flaps	VERIFY UP
☐ Temperature/Pressures	CHECK
☐ Landing Lights	AS REQUIRED
☐ Throttles	VERIFY FULL
☐ Airspeed	INCREASE TO ABOVE 150 MPH IAS
☐ Propellers	VERIFY DECREASE IN RPM AT 150 MPH IAS
☐ Mixtures	LEAN ABOVE 7,000 feet MSL (only when Boost/manifold pressure < -3 lbs/sq. in.) (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)

CRUISE (IDEALLY AT 10,000 FEET MSL)

☐ Throttles	FULL (press F2 and F3 as necessary)
☐ Mixtures	LEAN (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)

DESCENT

☐ Altimeters	SET
☐ Fuel Quantity	CHECK
☐ Fuel Valves	NORMAL FEED

☐ Tail Wheel	LOCKED
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Landing Lights	AS REQUIRED

APPROACH

☐ Mixture	RICH (press Ctrl+Shift+F3 until Full Rich)
☐ Carb Heat	AS REQUIRED (press H to toggle)

LANDING CHECK

☐ Landing Gear	DOWN AND LOCKED (press G to raise/lower)
☐ Wing Flaps	DOWN IN STAGES (<120 MPH IAS) (press F7 as necessary)
☐ Airspeed	85-95 MPH IAS

AFTER LANDING

☐ Wing Flaps	UP AND NEUTRAL (press F6 as necessary)
☐ Landing Lights	AS REQUIRED
☐ Trim Tabs	NEUTRAL (Set for Takeoff)
☐ Unnecessary Electrical	OFF
☐ Tail Wheel	UNLOCKED FOR TAXI

ENGINE SHUT-DOWN

☐ Tail Wheel	LOCKED
☐ Parking Brakes	SET (press Ctrl+Period key)
☐ Navigation Lights	OFF
☐ Mixtures	IDLE CUT-OFF (press Ctrl+Shift+F2 until Idle)
☐ Magnetos	OFF (press M+Minus key until Off)
☐ Brakes	RELEASED (press Period key)
☐ Master Switch	OFF

Douglas DC-3

BEFORE STARTING

☐ Wing Flaps	UP NEUTRAL; INDICATING UP (press F6 as necessary)
☐ Gear Handle	DOWN
☐ Spring Latch	LATCHED
☐ Parking Brake	SET (press Ctrl+Period key)
☐ Battery Switch	ON
☐ Radio Master	OFF
☐ Generators	ON
☐ Nav Lights	AS REQUIRED
☐ Magnetos	OFF (press M+Minus key until Off)
☐ Pitot Heat	OFF
☐ Prop Anti-ice	OFF
☐ Carb Heat	COLD (press H to toggle)
☐ Fuel Gauges	CHECKED
☐ Fuel Valves	MAINS
☐ Hydraulic Pressure	UP
☐ Props	FORWARD (press Ctrl+F3 until fully forward)
☐ Throttles	CRACKED (press F3 and F2 as necessary)
☐ Mixtures	IDLE CUTOFF (press Ctrl+Shift+F2 until fully back)
☐ Trim Tabs	(3) SET
☐ Cowl Flaps	OPEN & OFF
☐ Engine Rest Manifold Pressure	NOTED
☐ Flight Controls	FREE/Full travel
☐ Beacon	ON
☐ Boost Pumps	OFF

STARTING

Press Ctrl+E to initiate engine autostart sequence, or:
Start each engine in sequence (1, 2): Press E, then 1 or 2, to move focus to that engine.

☐ Master Switch	ON
☐ Mixture	AUTO RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Propeller Control	FULL FORWARD (low pitch) (press Ctrl+F3 until fully forward)
☐ Master Ignition Switch	ON
☐ Fuel Boost Pump	ON (right engine)
☐ Magnetos	BOTH (press M+Plus key until Both)
☐ Prime	AS REQUIRED
☐ Starter Switch	ENGAGE (press M+Plus key to Start and hold until engine starts)
☐ Oil Pressure	CHECK
☐ Fuel Pressure	CHECK
☐ Fuel Boost Pump	OFF
☐ Oil Pressure	CHECK
☐ Fuel Pressure	CHECK
☐ Vacuum Pressure	CHECK
☐ Hydraulic Pressure	CHECK

Press E, then 1, then 2, to move focus to both engines.

AFTER STARTING

☐ Temps/Press	CHECK
☐ Gear and Hydraulic Pressure	CHECK
☐ Boost Pumps	OFF
☐ Radio Master	ON
☐ Tail Wheel	UNLOCKED FOR TAXI

TAXI - WARM UP

☐ Brakes	CHECK (press Period key)
☐ Gyro Instruments	CHECK
☐ Altimeter	CHECK
☐ Flight Instruments	CHECK
☐ Carb Heat	CHECK (press H to toggle)

ENGINE RUN-UP

☐ Parking Brake	SET (press Ctrl+Period key)
☐ Temps & Press	CHECK
☐ Mixtures	AUTO RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttles	1,500 RPM (press F3 and F2 as necessary)
☐ Props	EXERCISE (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Feathering	CHECK (un-feather after 200 rpm drop)
☐ Generators	CHECK
☐ Heading Indicators	SET
☐ Vacuum Press	CHECK
☐ Pitot Heat	CHECK
☐ Magnetos	CHECK <100 rpm drop on each; <40 rpm drop between (press M+Minus key then M+Plus key to L, R, Both)
☐ Throttles	1,000 RPM (press F2 and F3 as necessary)

PRE-TAKEOFF

☐ Mixtures	AUTO RICH (press Ctrl+Shift+F3 until fully forward)
☐ Props	FORWARD (press Ctrl+F3 until fully forward)
☐ Trim Tabs	SET
☐ Flight Controls	FREE AND CORRECT
☐ Flaps	SET (press F7 and F6 as necessary)
☐ Radios	SET
☐ Briefing	COMPLETE

FINAL ITEMS

☐ Cowl Flaps	OPEN HALFWAY
☐ Boost Pumps	ON
☐ Pitot Heat	ON
☐ Tailwheel	LOCKED
☐ Heading Indicator	CHECK

TAKEOFF AND CLIMB (AT SEA LEVEL)

☐ Brakes	RELEASE
☐ Mixtures	AUTO RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttles	48" Hg MANIFOLD PRESSURE (press F2 and F3 as necessary)
☐ Propellers	2,750 RPM (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Landing Gear	RETRACT (when positive rate of climb is established) (press G)

AT 105 KIAS

☐ Throttles	35" Hg MANIFOLD PRESSURE (press F2 and F3 as necessary)
☐ Propellers	2,350 RPM (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Airspeed	MAINTAIN 105 KIAS

WHEN CLEAR OF OBSTACLES

☐ Airspeed	115-120 KIAS

AFTER TAKEOFF AND CLIMB

☐ Landing Gear	VERIFY UP
☐ Flaps	VERIFY UP
☐ Wings	CLEAN
☐ Temperature/Pressures	CHECK
☐ Boost Pumps	OFF (one at a time)
☐ Landing Lights	AS REQUIRED

CRUISE

☐ Throttles	SET (press F2 and F3 as necessary)
☐ Propellers	SET (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Mixtures	LEAN (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)
☐ Cowl Flaps	CLOSED

DESCENT

☐ Altimeters	SET
☐ Fuel Quantity	CHECK
☐ Fuel Valves	MAIN TANKS
☐ Hydraulic Pressure	CHECK
☐ Tail Wheel	LOCKED
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Landing Lights	AS REQUIRED

APPROACH

☐ Mixtures	RICH (press Ctrl+Shift+F3 until fully forward)

☐ Boost Pumps	ON
☐ Cowl Flaps	OPEN HALFWAY
☐ Carb Heat	AS REQUIRED (press H to toggle)

LANDING CHECK

☐ Landing Gear	DOWN AND LOCKED (press G to lower/raise)
☐ Wing Flaps	AS REQUIRED (press F7 as necessary)
☐ Propellers	SET (press Ctrl+F2 and Ctrl+F3 as necessary)

AFTER LANDING

☐ Wing Flaps	UP AND NEUTRAL (press F6 as necessary)
☐ Propellers	LOW RPM (press Ctrl+F2 until fully back)
☐ Cowl Flaps	OPEN
☐ Pitot Heat	OFF
☐ Carb Heat	OFF (press H to toggle)
☐ Boost Pumps	OFF
☐ Landing Lights	AS REQUIRED
☐ Trim Tabs	NEUTRAL (Set for Takeoff)
☐ Unnecessary Electrical	OFF
☐ Tail Wheel	UNLOCKED FOR TAXI

ENGINE SHUT-DOWN

☐ Tail Wheel	LOCKED
☐ Parking Brakes	SET (press Ctrl+Period key)
☐ Radio Master	OFF
☐ Mixtures	IDLE CUT-OFF (press Ctrl+Shift+F2 until fully back)
☐ Beacon	OFF
☐ Navigation Lights	OFF
☐ Magnetos	OFF (press M+Minus key until Off)
☐ Flap and Gear Handles	SET
☐ Brakes	RELEASED (press Period key)
☐ Master Switch	OFF

Extra 300S

BEFORE STARTING ENGINE

☐ Brakes	TEST and SET (press Ctrl+ Period key)
☐ Master Switch	ON
☐ Avionics Master Switch	OFF
☐ Electrical Equipment	OFF
☐ Alternator	ON
☐ Nav/Strobe Lights	ON

ENGINE START

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Throttle	OPEN 1/4 travel (press F3 or F2 as necessary)
☐ Boost Pump	ON START (release when engine starts) (press M+Plus key to R, L, Both, Start)
☐ Boost Pump	OFF

Then:

☐ Oil Pressure	CHECK
☐ Avionics Master Switch	ON

BEFORE TAKEOFF

☐ Flight Controls	FREE and CORRECT
☐ Flight Instruments	CHECK and SET
☐ Oil Pressure	CHECK
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Fuel Quantity	CHECK
☐ Throttle	1,800 RPM (press F3 or F2 as necessary)
☐ Magnetos	CHECK <175 rpm drop on each; <50 rpm drop between (press M+Minus key, then press M+Plus key to L, R, L, Both)
☐ Propeller	CYCLE high rpm/low rpm/high rpm (press Ctrl+F3 until fully in, then press Ctrl+F2 until fully out, then press Ctrl+F3 until fully in)
☐ Boost Pump	ON (check fuel flow)
☐ Engine Instruments and Ammeter	CHECK
☐ Throttle	800-1,000 RPM (press F2 or F3 as necessary)
☐ Strobe Lights	AS DESIRED
☐ Avionics Master Switch	ON
☐ Radios and Avionics	SET (press Shift+2 to display radio stack)
☐ Brakes	RELEASE (press Period key)

TAKEOFF

☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)

☐ Mixture	RICH (may be leaned above 3000 ft) (press Ctrl+Shift+F3 or Ctrl+Shift+F2 as necessary)
☐ Throttle	FULL (press F3 until fully in)
☐ Elevator Control	GENTLY PUSH FORWARD ON STICK (until tail comes up)
--At 65 KIAS, pull back and fly off the runway--	
☐ Propeller	2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Climb Speed	100 KIAS (normal climb)
☐ Boost Pump	OFF

CRUISE

☐ Throttle	AS DESIRED (press F2 or F3 as necessary)
☐ Propeller	AS DESIRED (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	LEAN (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Elevator Trim	ADJUST (with Num Lock off press Num Pad 1 or Num Pad 7 as necessary)

DESCENT

☐ Throttle	REDUCE (press F2 as necessary)
☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until fully in)
☐ Propeller	2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Elevator Trim	ADJUST (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)

BEFORE LANDING

☐ Boost Pump	ON
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Airspeed	80 KIAS

LANDING

☐ Airspeed	80 KIAS on approach 70 KIAS on final
☐ Trim	ADJUST (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ Touchdown	ALL THREE WHEELS SIMULTANEOUSLY
☐ Throttle	IDLE (press F2 as necessary)
☐ Braking	MINIMUM REQUIRED (press Period key)

SECURING AIRPLANE

☐ Boost Pump	OFF
☐ Engine	RUN for 1 minute at 1,000 RPM
☐ Throttle	IDLE (press F2 as necessary)
☐ Avionics Switch, Electrical Equipment	OFF
☐ Mixture	IDLE CUT-OFF (pulled fully out) (press Ctrl+Shift+F2 until fully out)
☐ Ignition Switch	OFF (press M+Minus key until Off)
☐ Master Switch	OFF

Ford 4-AT-E Tri-Motor

BEFORE STARTING

☐ Cabin Door	SECURE
☐ Fuel Quantities	CHECKED
☐ Fuel Valves	LEFT/CENTER/RIGHT
☐ Carb Heat	COLD (press H to toggle)
☐ Trim	SET
☐ Parking Brake	SET (press Ctrl+Period key)
☐ Prime	5 STROKES EACH ENGINE (IF COLD)
☐ Master Switch	ON
☐ Ignition Switches	OFF
☐ Mixtures	FULL RICH (press Ctrl+Shift+F3 until fully forward)

STARTING

Press Ctrl+E to initiate engine autostart sequence, or:
Start each engine in sequence (2, 1, 3): Press E, then 2, 1, or 3, to move focus to that engine.

☐ Prop Clear	CHECK
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Start Switch	ENGAGE FOR 1 ENGINE REVOLUTION (press M+Plus key to R, L, Both, Start and hold until engine starts)
☐ Ignition	BOTH
☐ Oil Pressure	CHECK
☐ Throttle	1,000 RPM (press F3 and F2 as necessary)
☐ Generator	ON

☐ Suction	CHECK

(Repeat for each engine. Press E, then 1, then 2, then 3, to move focus to all engines)

AFTER STARTING

☐ Temps/Press	CHECK
☐ Lights	AS NECESSARY
☐ Flight Instruments	SET
☐ Flight Controls	FREE AND CORRECT

TAXI AND WARM-UP (5 MINUTES)

☐ Brakes	CHECK (press Period key)
☐ Carb Heat	CHECK (press H to toggle)
☐ Flight Controls	CORRECT FOR WIND

ENGINE RUN-UPS (REPEAT FOR EACH ENGINE)

Press E, then 1, 2, or 3, to move focus to that engine.

☐ Parking Brake	SET
☐ Mixtures	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttle	1,500 RPM
☐ Ignition	CHECK <100 rpm drop on each; <40 rpm drop between (press M+Minus key then M+Plus key to L, R, Both)
☐ Carb Heat	CHECK FOR RPM DROP (press H to toggle)
☐ Engine Instruments	CHECK IN GREEN
☐ Generator	CHECK ON LINE
☐ Suction	CHECK
☐ Flight Instruments	CHECK AND SET
☐ Throttle	1,000 RPM (press F2 and F3 as necessary)
☐ Generator (Center Engine)	ON

Press E, then 1, then 2, then 3, to move focus to all engines.

PRE-TAKEOFF

☐ Fuel Controls	CHECK
☐ Mixtures	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Props	FORWARD (press Ctrl+F3 until fully forward)
☐ Carb Heat	CHECK COLD (press H to toggle)
☐ Trim	SET FOR TAKEOFF
☐ Controls	FREE AND CORRECT
☐ Engines	VISUALLY CHECK

TAKEOFF (AT SEA LEVEL)

☐ Brakes	RELEASE (press Period key)
☐ Throttles (Engines 1 and 3)	1,000 RPM (press E, then 1, then 3, to move focus to left and right engines) (press F3 as necessary)
☐ Throttle (Engine 2)	1,000 RPM (press E, then 2, to move focus to center engine) (press F3 as necessary)

Press E, then 1, then 2, then 3, to move focus to all engines.

☐ Throttles (All)	FULL (press F3 until fully forward)
☐ Airspeed	ROTATE AT 60 MPH

AFTER TAKEOFF AND CLIMB

☐ Airspeed	75 MPH
☐ Throttles	2,000 RPM (press F2 and F3 as necessary)
☐ Temperature/Pressures	CHECK

CRUISE

☐ Throttles	1,750-1,900 RPM (press F2 and F3 as necessary)
☐ Mixtures	LEAN AS NECESSARY (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)

DESCENT

☐ Altimeter	SET
☐ Fuel Quantity	CHECK
☐ Fuel Valves	MAIN TANKS
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Landing Lights	AS REQUIRED

APPROACH

☐ Mixtures	RICH (press Ctrl+Shift+F3 until fully forward)
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Airspeed	75-80 MPH
☐ Landing Lights	AS REQUIRED

LANDING

☐ Airspeed	60-65 MPH
☐ Throttles	IDLE (on touchdown) (press F2 until Idle)
☐ Landing Lights	AS REQUIRED

AFTER LANDING

☐ Landing Lights	AS REQUIRED
☐ Trim	NEUTRAL (Set for Takeoff)
☐ Unnecessary Electrical	OFF
☐ Flight Controls	CORRECT FOR WIND

ENGINE SHUT-DOWN

☐ Parking Brakes	SET (press Ctrl+Period key)
☐ Throttles	1,000 RPM
☐ Mixtures	IDLE CUT-OFF (press Ctrl+Shift+F2 until fully back)
☐ Ignition Switches	OFF (press M+Minus key until Off)
☐ Generator	OFF
☐ Master Switch	OFF
☐ Brakes	RELEASED (press Period key)

Learjet 45

BEFORE STARTING ENGINES

☐ Gear	CHECK DOWN
☐ BATT Switch	ON
☐ L and R GEN Switches	OFF
☐ Flight Controls	CHECK
☐ Engine Instruments	CHECK
☐ Fuel Quantity	CHECK
☐ De-ice	OFF
☐ Aircraft Lighting	OFF
☐ Parking Brake	SET (press Ctrl + Period key)
☐ Trim	AS DESIRED (with Num Lock off press Num Pad 1 or Num Pad 7 as necessary)
☐ Altimeters	SET
☐ Standby Instruments	SET
☐ Takeoff Data (V1, VR, V2)	COMPUTED and SPEEDS SET (see the Reference page of the Kneeboard)
☐ Avionics Master Switch	ON
☐ Avionics	SET FOR DEPARTURE

STARTING ENGINES

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Beacon/Strobe Switch	BCN/STROBE
☐ Parking Brake	SET (press Ctrl + Period key)
☐ Thrust Levers	IDLE (press F2 or F3 as necessary)
☐ Fuel Flow	ON (press Ctrl+Shift+F4)
☐ L Start Switch	ON (click and hold until engine starts)
☐ L FF (Fuel Flow)	CHECK
☐ L N1 Increases as L N2 Increases	CHECK
☐ L ITT	CHECK
☐ L Oil Pressure	CHECK
☐ L Engine Instruments	CHECK NORMAL
☐ R Start Switch	ON (click and hold until engine starts)
☐ R FF (Fuel Flow)	CHECK
☐ R N1 Increases as L N2 Increases	CHECK
☐ R ITT	CHECK
☐ R Oil Pressure	CHECK
☐ R Engine Instruments	CHECK NORMAL
☐ L and R GEN Switches	ON

BEFORE TAXI

☐ De-ice	ON
☐ Spoiler Lever	ARM (press Shift + / [forward slash key])
☐ Flaps	SET 8 OR 20 DEGREES (press F6 or F7 as necessary)
☐ Flight Controls	CHECK
☐ Aircraft Lighting	ON AS REQUIRED
☐ Brakes	RELEASE (press Period key)

TAXI AND BEFORE TAKEOFF

☐ Brakes	CHECK (press Period key)
☐ Flight Instruments	CHECK
☐ Engine Instruments	CHECK
☐ Takeoff Data (V1, VR, V2)	CHECK (see the Reference page of the Kneeboard)
☐ Nav Equipment	CHECK
☐ Transponder	ON
☐ Flaps	SET 8 OR 20 DEGREES (press F6 or F7 as necessary)
☐ Trim	SET FOR TAKEOFF (with Num Lock off, press Num Pad 1 or Num Pad 7 as necessary)
☐ De-ice	AS REQUIRED

RUNWAY LINEUP

☐ Lights	ON

TAKEOFF

☐ Thrust Lever	T/O (press F3 until T/O)
☐ Brakes	RELEASE (press Period key)
☐ VR	ROTATE

AFTER TAKEOFF

☐ Gear	UP AFTER POSITIVE RATE OF CLIMB
☐ Flaps	UP AT V2+25
☐ Yaw Damper	ON AS REQUIRED
☐ Spoiler Lever	RET (press Shift + / (forward slash key) until retracted)
☐ De-ice	AS REQUIRED

☐ L and R LDG-TAXI Light Switches	OFF

CLIMB

CAUTION: Maximum thrust lever setting is MCR with full anti-ice on between 15,500 and 30,000 feet.

☐ Altimeters	RESET TO 29.92 CROSSING 18,000 FEET

DESCENT

☐ De-ice	AS REQUIRED

CAUTION: Maximum thrust lever setting is MCR with full anti-ice on between 15,500 and 30,000 feet.

☐ Altimeters	RESET TO LOCAL CROSSING 18,000 FEET
☐ Fuel Quantities and Balance	CHECK

APPROACH

☐ Landing Data (VREF, VAPP)	COMPUTED and SPEEDS SET (see the Reference page of the Kneeboard)
☐ Avionics and Radios	SET
☐ Flaps	SET 8 OR 20 DEGREES (press F6 or F7 as necessary)
☐ Spoiler Lever	ARM (press Shift + / [forward slash key])

BEFORE LANDING

☐ Gear	DN (Check for 3 green lights) (press G)
☐ L and R LDG-TAXI Light Switches	ON
☐ Flaps	DN, check indication (press F7 until Dn)

LANDING

☐ Brakes	AS REQUIRED (press Period key)
☐ Spoilers	VERIFY EXTENDED

AFTER LANDING/CLEARING RUNWAY

☐ Transponder	OFF
☐ De-ice	AS REQUIRED
☐ Lights	AS DESIRED
☐ Spoiler Lever	RET (press Shift + / (forward slash key) until retracted)
☐ Flaps	b (press F6 until Up)
☐ Thrust Lever	CUTOFF (press F2 until Cutoff)

SHUTDOWN

☐ Parking Brake	SET (press Ctrl + Period key)
☐ De-Ice	OFF
☐ Thrust Levers	IDLE (press F2 until Idle)
☐ Fuel Flow	OFF (press Ctrl+Shift+F1)
☐ Lights	OFF
☐ L and R GEN Switches	OFF
☐ BATT Switch	OFF

Model 5B and 5C Vega

BEFORE STARTING

☐ Master Battery Switch	ON
☐ Generator	ON
☐ Lights	AS REQUIRED
☐ Magnetos	OFF (press M+Minus key until Off)
☐ Carb Heat	COLD (press H to toggle)
☐ Fuel Tank Selector	MAIN
☐ Trim	SET
☐ Controls	FREE/Full travel

STARTING

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Master Battery Switch	ON
☐ Generator	ON
☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Propeller Control	FULL FORWARD (low pitch) (press Ctrl+F3 until fully forward)
☐ Prime	AS REQUIRED
☐ Magneto Switch	START (press M+Plus key to R, L, Both, Start and hold until engine starts)
☐ Oil Pressure	CHECK
☐ Oil Temperature	CHECK
☐ Suction	CHECK

TAXI - WARM UP

☐ Brakes	CHECK (press Period key)
☐ Gyro Instruments	CHECK
☐ Altimeter	CHECK
☐ Flight Instruments	CHECK

ENGINE RUN-UP

☐ Brakes	SET (press and hold Period key)
☐ Temps & Press	CHECK
☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttle	1,750 RPM
☐ Prop	EXERCISE (press Ctrl+F2 and Ctrl+F3 as necessary)

☐ Heading Indicator	SET
☐ Suction	CHECK
☐ Magnetos	CHECK <100 rpm drop on each; <40 rpm drop between (click each to OFF then ON)
☐ Carb Heat	CHECK (press H to toggle)
☐ Throttle	1,000 RPM OR LESS (press F2 or F3 as necessary)

PRE-TAKEOFF

☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Trim	SET
☐ Flight Controls	FREE AND CORRECT
☐ Carb Heat	COLD (press H to toggle)

TAKEOFF AND CLIMB

☐ Brakes	RELEASE
☐ Mixture	FULL RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttle	FULL (press F3 as necessary)
☐ Rotate	75-80 MPH
☐ Throttle	2,200 RPM (press F2 and F3 as necessary)
☐ Airspeed in Climb	110-120 MPH IAS

AFTER TAKEOFF AND CLIMB

☐ Temperature/Pressures	CHECK
☐ Landing Lights	AS REQUIRED
☐ Throttle	30" MANIFOLD PRESSURE
☐ Prop	2,100 RPM
☐ Mixture	LEAN AS NECESSARY (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)
☐ Airspeed	110-120 MPH IAS

CRUISE

☐ Throttle	25" MANIFOLD PRESSURE (press F2 and F3 as necessary)
☐ Prop	2,100 RPM (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Mixture	LEAN (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)

DESCENT

☐ Altimeters	SET
☐ Fuel Selector	MAIN
☐ Throttle	20" MANIFOLD PRESSURE (press F2 and F3 as necessary)
☐ Prop	2,050 RPM (press Ctrl+F2 and Ctrl+F3 as necessary)
☐ Mixture	ENRICH (press Ctrl+Shift+F3 as necessary)
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Landing Light	AS REQUIRED
☐ Airspeed	140 MPH IAS

APPROACH

☐ Mixture	RICH (press Ctrl+Shift+F3 until fully forward)
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Airspeed	85-95 MPH IAS
☐ Landing Lights	AS REQUIRED

LANDING

☐ Airspeed	80-85 MPH IAS

AFTER LANDING

☐ Landing Lights	AS REQUIRED
☐ Trim	NEUTRAL (Set for Takeoff)

ENGINE SHUT-DOWN

☐ Lights	OFF
☐ Generator	OFF
☐ Mixture	IDLE CUT-OFF (press Ctrl+Shift+F2 until fully back)
☐ Magnetos	OFF (press M+Minus key until Off)
☐ Master Switch	OFF

Mooney Bravo

BEFORE STARTING ENGINE

☐ Magneto/Starter Switch	OFF
☐ Master Switch	OFF
☐ Fuel Boost Pump Switch	OFF
☐ Throttle	CLOSED (press F2 until fully out)
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Mixture	IDLE CUT-OFF (press Ctrl+Shift+F2 until fully out)
☐ Parking Brakes	SET (press Ctrl+Period key)
☐ Master Switch	ON
☐ Cowl Flaps	OPEN
☐ Flaps	UP (press F6 until UP)
☐ Master Switch	OFF

☐ Landing Gear Switch	DOWN

ENGINE START

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Throttle	OPEN 1/4 INCH (press F3 or F2 as necessary)
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Master Switch	ON
☐ Fuel Boost Pump Switch	ON for 0-40 sec. (depending on temp.)
☐ Fuel Boost Pump Switch	OFF
☐ Propeller Area	CLEAR
☐ Magneto/Starter Switch	START (release when engine starts) (press M+Plus key to R, L, Both, Start)
☐ Throttle	IDLE (700-750 rpm) (press F3 or F2 as necessary)

Then:

☐ Oil Pressure	CHECK
☐ Ammeter	CHECK
☐ Engine Instruments	CHECK

BEFORE TAXI

☐ Avionics Master Switch	ON
☐ Heading Indicator	SET
☐ Instruments	NORMAL OPERATION
☐ Radios and Avionics	CHECKED and SET (press Shift+2 to display radio stack)
☐ Altimeter	SET
☐ Fuel Selector	SWITCH TANKS (verify engine operation on both)
☐ Cowl Flaps	FULL OPEN

TAXI

☐ Rudder Trim	AS DESIRED
☐ Parking Brake	RELEASE (press Period key)
☐ Brakes	CHECK during taxi
☐ Directional Gyro	PROPER INDICATION during turns
☐ Turn Coordinator	PROPER INDICATION during turns
☐ Artificial Horizon	ERECT during turns
☐ Throttle	MINIMUM POWER
☐ Cowl Flaps	OPEN
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)

BEFORE TAKEOFF

☐ Parking Brake	SET (press Ctrl+Period)
☐ Fuel Selector Valve	FULLEST TANK
☐ Throttle	1,000 RPM (press F2 or F3 as necessary)
☐ Cowl Flaps	OPEN
☐ Propeller	HIGH RPM (press Ctrl+F3 until fully in)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Alternator Switch	VERIFY ON
☐ Throttle	2,000 RPM (press F2 or F3 as necessary)
☐ Magnetos	CHECK <150 rpm drop on each, <50 rpm drop between (press M+Minus key then M+Plus key to L, R, L, Both)
☐ Propeller	CYCLE high rpm/low rpm/high rpm (press Ctrl+F3 until fully in, then Ctrl+F2 until fully out, then Ctrl+F3 until fully in)
☐ Ammeter	CHECK Positive charge indication
☐ Throttle	1,000 RPM (press F2 or F3 as necessary)
☐ Fuel Boost Pump Switch	ON (verify annunciator lit)
☐ Elevator Trim	SET for takeoff (with NumLock off press NumPad 1 or NumPad 7 as necessary)
☐ Rudder Trim	SET for takeoff
☐ Flaps	CHECK and SET for takeoff (10 degrees) (press F6 or F7 as necessary)
☐ Flight Controls	FREE AND CORRECT
☐ Radios and Avionics	SET (press Shift+2 to display radio stack)
☐ Annunciator Lights	CHECK (press Shift+4 to display annunciator panel)
☐ Strobe Lights/Beacon	ON
☐ Oil Temperature	CHECK
☐ Cylinder Head Temperature	CHECK
☐ Parking Brake	RELEASE (press Period key)

TAKEOFF

☐ Throttle	FULL (press F3 until fully in)
☐ Annunciator Lights	CHECK
☐ Lights	AS DESIRED
☐ Engine Instruments	CHECK
☐ Liftoff Speed	60 KIAS

☐ Climb Speed	85 KIAS
☐ Landing Gear	RETRACT IN CLIMB after clearing obstacles (press G)
☐ Flaps	UP (press F6 until Up)
☐ Fuel Boost Pump Switch	OFF

BEST RATE CLIMB

☐ Throttle	FULL (press F3 until fully in)
☐ Propeller	2,575 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Cowl Flaps	FULL OPEN
☐ Rudder Trim	AS DESIRED
☐ Airspeed	105 KIAS

BEST ANGLE CLIMB

☐ Throttle	FULL (press F3 until fully in)
☐ Propeller	2,575 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Cowl Flaps	FULL OPEN
☐ Rudder Trim	AS DESIRED
☐ Airspeed	85 KIAS

CRUISE CLIMB

☐ Throttle	34" MP (press F2 or F3 as necessary)
☐ Propeller	2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully in)
☐ Cowl Flaps	FULL OPEN or as required
☐ Rudder Trim	AS DESIRED
☐ Airspeed	120 KIAS

CRUISE

☐ Airspeed	ACCELERATE to cruise airspeed
☐ Throttle	AS DESIRED (press F2 or F3 as necessary)
☐ Propeller	AS DESIRED (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	LEAN TO PEAK TIT (<1,750) (press Ctrl+Shift+F2 or Ctrl+Shift+F3 as necessary)
☐ Engine Instruments	CHECK
☐ Cowl Flaps	AS REQUIRED (to maintain normal Cylinder Head and Oil temperatures)
☐ Engine Temperatures	STABILIZE at cruise condition
☐ Rudder Trim	AS DESIRED

FUEL TANK SELECTION

☐ Fuel Boost Pump Switch	ON
☐ Fuel Selector	OPPOSITE TANK
☐ Fuel Boost Pump Switch	OFF

DESCENT

☐ Flaps	UP (press F6 until Up)
☐ Landing Gear	CHECK UP
☐ Throttle	ABOVE 15" MP (keep CHT in green) (press F2 or F3 as necessary)
☐ Propeller	2,400 RPM (press Ctrl+F2 or Ctrl+F3 as necessary)
☐ Mixture	PEAK TIT (press Ctrl+Shift+F3 or Ctrl+Shift+F2 as necessary)
☐ Cowl Flaps	CLOSED
☐ Cylinder Head Temperature (CHT)	MONITOR
☐ Airspeed	AS DESIRED (195 KIAS max.)
☐ Rudder Trim	AS DESIRED

APPROACH FOR LANDING

☐ Lights	AS DESIRED
☐ Landing Gear	EXTEND (below 140 KIAS) and CHECK DN (press G)
☐ Mixture	RICH (on final) (press Ctrl+Shift+F3 until fully in)
☐ Propeller	HIGH RPM (on final) (press Ctrl+F3 until fully in)
☐ Fuel Boost Pump	ON
☐ Fuel Selector	FULLEST TANK
☐ Flaps	FULL DOWN (below 110 KIAS) (press F7 until DN)
☐ Elevator Trim	AS DESIRED (with NumLock off press NumPad 1 or NumPad 7 as necessary)
☐ Rudder Trim	CENTERED OR AS DESIRED
☐ Parking Brake	VERIFY OFF (press Period key)

LANDING

☐ Airspeed	75 KIAS
☐ Touchdown	MAIN WHEELS FIRST
☐ Landing Roll	LOWER NOSE WHEEL GENTLY
☐ Brakes	MINIMUM REQUIRED (press Period key)

TAXI AFTER LANDING

☐ Throttle	AS REQUIRED (press F2 or F3 as necessary)
☐ Fuel Boost Pump	OFF
☐ Cowl Flaps	OPEN
☐ Flaps	RETRACT (press F6 until UP)
☐ Elevator Trim	TAKEOFF SETTING (with NumLock off press NumPad 1 or NumPad 7 as necessary)
☐ Avionics/Radios	AS REQUIRED (press Shift+2 to display radio stack)
☐ Lights	AS DESIRED

SHUTDOWN

☐ Parking Brake	SET (press Ctrl+Period)
☐ Throttle	IDLE (press F2 as necessary)
☐ Avionics Switch, Electrical Equipment	OFF
☐ Lights	OFF
☐ Pitot Heat	OFF
☐ Mixture	IDLE CUT-OFF (pulled fully out) (press Ctrl+Shift+F2 until fully out)
☐ Master Switch	OFF
☐ Magneto/Starter Switch	OFF (press M+Minus key until Off)

SECURING AIRCRAFT

☐ Magneto/Starter Switch	Verify OFF
☐ Master Switch	Verify OFF
☐ Avionics Switch	Verify OFF
☐ Electrical Switches	Verify OFF

Piper J-3 Cub

STARTING

In the real-world Piper Cub, you'd have to hand-prop the aircraft. In Flight Simulator, press Ctrl+E to initiate engine autostart sequence, or:

☐ Fuel Valve	ON (click with mouse)
☐ Mixture	RICH (press Ctrl+Shift+F3 as necessary)
☐ Carb Heat	OFF (press H to toggle)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Prime	AS NECESSARY
☐ Brakes	ON (press Ctrl+Period key)
☐ Magneto Switch	START (press M+Plus SIGN to L, R, Both, Start and hold until engine starts)
☐ Oil Pressure	CHECK 10 PSI MINIMUM

TAXI AND RUN-UP

☐ Controls	FREE AND CORRECT
☐ Instruments	CHECK AND SET
☐ Fuel Valve	ON
☐ Trim	SET FOR TAKEOFF
☐ Brakes	ON
☐ Throttle	1,500 RPM (press F3 or F2 as necessary)
☐ Magnetos	CHECK <75 rpm drop on each (press M+Minus key, then press M+Plus key to R, L, R, Both)
☐ Carb Heat	CHECK RPM DROP
☐ Oil Pressure	30–45 PSI
☐ Throttle	1,000 RPM OR LESS (press F2 or F3 as necessary)
☐ Radio	CHECK

TAKEOFF AND CLIMB (AT SEA LEVEL)

☐ Brakes	RELEASED (press Period key)
☐ Throttle	FULL (press F3 as necessary)
☐ Nose	COMES DOWN
☐ Rotate	45 MPH
☐ Climb Airspeed	55-60 MPH

CRUISE

☐ Throttle	2,150 RPM (press F2 and F3 as necessary)
☐ Oil Pressure	MONITOR
☐ Oil Temperature	MONITOR

DESCENT

☐ Altimeter	SET
☐ Fuel Valve	VERIFY ON
☐ Throttle	REDUCE
☐ Carb Heat	AS NECESSARY (press H to toggle)

LANDING

☐ Airspeed	50-60 MPH
☐ Throttle	IDLE (on touchdown)

ENGINE SHUT-DOWN

☐ Throttle	IDLE (press F2 as necessary)
☐ Mixture	CUTOFF (press M+Minus key until Off)
☐ Magneto Switch	OFF (press M+Minus key until Off)
☐ Fuel Valve	OFF (click with mouse)
☐ Radio	OFF
☐ Trim	SET FOR TAKEOFF

Robinson R22 Beta II

BEFORE STARTING ENGINE

☐ Fuel Shut-off Valve	ON
☐ Cyclic, Collective, Pedals	FULL TRAVEL FREE
☐ Throttle	FULL TRAVEL FREE (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Collective	FULL DOWN (press F2 as necessary)
☐ Cyclic	NEUTRAL
☐ Pedals	NEUTRAL
☐ Governor	OFF
☐ Carb Heat	OFF (press H)
☐ Mixture	FULL RICH (press F3 as necessary)
☐ All Switches/Avionics	OFF
☐ Clutch	DISENGAGED
☐ Altimeter	SET
☐ Rotor Brake	DISENGAGED

STARTING ENGINE AND RUN-UP

Press Ctrl+E to initiate engine autostart sequence, or:

☐ Master Battery Switch	ON
☐ Throttle Twists for Priming	AS REQUIRED (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Throttle	CLOSED (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Area	CLEAR
☐ Strobe Light	ON
☐ Ignition Switch	START, THEN BOTH (press M+Plus key to L, R, Both, Start and hold until engine starts)
☐ Starter ON Light	OUT
☐ Set Idle Speed	55% (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Clutch Switch	ENGAGED (no delay)
☐ Alternator Switch	ON (no delay)
☐ Blades Turning	LESS THAN 5 SECONDS
☐ Oil Pressure in 30 Seconds	25 PSI MINIMUM
☐ Avionics	ON
☐ Wait for Clutch Light	OUT
☐ Warm-up RPM	70-75% (press Ctrl+F3 and Ctrl+F2 as necessary)
☐ Engine Gauges	GREEN
☐ Warning Lights	OUT
☐ Mag Drop at 75% RPM	7% max in 2 sec (press M+Minus key then M+Plus key to R, L, R, Both)
☐ Carb Heat Check	CAT RISE/DROP (press H)
☐ Sprag Clutch Check from 75% RPM	NEEDLES SPLIT (press Ctrl+F2 to momentarily drop engine rpm, then press Ctrl+F3 to return to 75%)
☐ Doors	CLOSED AND LATCHED
☐ Governor	ON
☐ Throttle	102-104% (Governor takes over above 80%) (press Ctrl+F3 as necessary)
☐ RPM	VERIFY 102-104%

TAKEOFF PROCEDURE

1. Verify governor ON, rpm stabilized at 102-104%. 2. Clear area. 3. Check that gauges are in the green. 4. Lower nose and accelerate to climb speed. If rpm drops below 102%, lower collective.

CRUISE

1. Adjust carb heat if required. 2. Verify rpm is near top of green arc. 3. Set manifold pressure with collective for desired power setting. 4. Pull RT TRIM knob.

APPROACH AND LANDING

1. Make final approach into the wind at lowest practical rate of descent, with an initial airspeed of 60 knots. 2. Reduce airspeed and altitude smoothly to hover. (Be sure the rate of descent is less than 300 fpm before the airspeed is reduced below 30 KIAS.) 3. From hover, lower collective gradually until ground contact. 4. After initial ground contact, lower collective to full down position.

SHUTDOWN PROCEDURE

☐ Collective	DOWN
☐ Cyclic/Pedals	NEUTRAL
☐ Governor	OFF
☐ Idle at 70-80%	CHT DROP
☐ Throttle	CLOSED
☐ Clutch Switch	DISENGAGE
-- Wait 30 Seconds --	
☐ Mixture	IDLE CUT-OFF (press Ctrl+Shift+F2 until Off)
-- Wait 30 Seconds --	
☐ Rotor Brake	APPLY
☐ Clutch Light	OFF
☐ All Switches	OFF

Ryan NYP *Spirit of St. Louis*

STARTING

In the real-world *Spirit* you'd have to hand-prop the aircraft. In Flight Simulator, press Ctrl+E to initiate engine autostart sequence, or:

☐ Door	CLOSED
☐ Mixture	RICH (press Ctrl+Shift+F3 until fully forward)
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Oil Pressure	CHECK
☐ Magneto Switch	START (press M+Plus key to R, L, Both, Start and hold until engine starts)

TAXI - WARM UP

☐ Altimeter	CHECK
☐ Flight Instruments	CHECK

PRE-TAKEOFF

☐ Flight Controls	FULL AND FREE
☐ Trim	SET FOR TAKEOFF
☐ Door	SECURE
☐ Altimeter	SET
☐ Mixture	RICH (press Ctrl+Shift+F3 until Rich)
☐ Throttle	1,600 RPM (press F3 and F2 as necessary)
☐ Magnetos	CHECK (press M+Minus key and M+Plus key to L, R, L, Both)
☐ Engine Instruments	CHECK
☐ Carb Heat	CHECK (press H to toggle)
☐ Throttle	1,000 RPM (press F2 and F3 as necessary)

TAKEOFF AND CLIMB (AT SEA LEVEL)

☐ Mixture	RICH (press Ctrl+Shift+F3 as necessary)
☐ Throttle	FULL (press F3 as necessary)
☐ Airspeed in climb	80 MPH IAS
☐ Throttle	REDUCE TO 1,900 AS SOON AS PRACTICAL (press F2 as necessary)

AFTER TAKEOFF AND CLIMB

☐ Temperature/Pressures	CHECK
☐ Throttle	1,750 RPM
☐ Mixture	LEAN AS NECESSARY (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)

CRUISE

☐ Throttle	1,600-1,750 RPM (press F2 and F3 as necessary)
☐ Mixture	LEAN AS NECESSARY (press Ctrl+Shift+F2 and Ctrl+Shift+F3 as necessary)

DESCENT

☐ Altimeters	SET
☐ Fuel Quantity	CHECK
☐ Fuel Selector	MAIN
☐ Throttle	REDUCE (press F2 and F3 as necessary)
☐ Mixture	ENRICH (press Ctrl+Shift+F3 as necessary)
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Airspeed	120 MPH IAS

APPROACH

☐ Mixture	RICH (press Ctrl+Shift+F3 until Rich)
☐ Carb Heat	AS REQUIRED (press H to toggle)
☐ Airspeed	65-75 MPH IAS

LANDING

☐ Airspeed	65-70 MPH IAS

AFTER LANDING

☐ Trim	NEUTRAL (Set for Takeoff)

ENGINE SHUT-DOWN

☐ Mixture	IDLE CUT-OFF (press Ctrl+Shift+F2 until engine stops)
☐ Magnetos	OFF

Schweizer 2-32 Sailplane

BEFORE TAKEOFF

☐ Radio	SET
☐ Spoilers/Dive Brakes	CLOSED (press \ [backward slash] key)

TAKEOFF (USING SLEW MODE)

☐ Slewing	ACTIVATE (press Y)
☐ Altitude	INCREASE (press F4 as necessary)
☐ Slewing	DEACTIVATE (press Y)

CRUISE

☐ Airspeed	66 MPH IAS for cruise 54 MPH IAS for minimum sink

DESCENT/APPROACH

☐ Airspeed	65 MPH IAS
☐ Spoiler/Dive Brake	AS NEEDED to increase descent rate (press \ [backward slash] key)

LANDING

☐ Airspeed	SLOW TO 50 MPH IAS over runway threshold
☐ Land	SETTLE onto runway (don't flare)

Vickers F.B.27A Vimy

STARTING

Press Ctrl+E to initiate engine autostart sequence, or:

PORT ENGINE (PRESS E, THEN 1, TO MOVE FOCUS TO LEFT ENGINE)

☐ Master Switch	ON
☐ Port Petrol Valve	ON
☐ Port Petrol Pump	ON
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Port Magneto Switches	ON (press M+Plus key until both On)
☐ Port Start Switch	ENGAGE (press M+Plus key and hold until engine starts)
☐ Port Oil Pressure	CHECK
☐ Port Fuel Pressure	CHECK
☐ Port Oil Temperature	CHECK

STARBOARD ENGINE (PRESS E, THEN 2, TO MOVE FOCUS TO RIGHT ENGINE)

☐ Starboard Petrol Valve	ON
☐ Starboard Petrol Pump	ON
☐ Throttle	CRACKED (press F3 and F2 as necessary)
☐ Starboard Magneto Switches	ON (press M+Plus key until both On)
☐ Starboard Start Switch	ENGAGE (press M+Plus key and hold until engine starts
☐ Starboard Oil Pressure	CHECK
☐ Starboard Fuel Pressure	CHECK
☐ Starboard Oil Temperature	CHECK

Press E, then 1, then 2, to move focus to both engines

TAXI

☐ Lights	AS NECESSARY
☐ Altimeter	CHECK

TAKEOFF AND CLIMB (AT SEA LEVEL)

☐ Throttles	FULL (press F3 as necessary)
☐ Rotate	40-45 MPH
☐ Airspeed	60-70 MPH (same pitch attitude as on runway)
☐ Starboard Oil Temperature	CHECK
☐ Petrol Pumps	OFF

NOTE: Fully loaded Vimy climbs at 1,000 feet per hour!

CRUISE

☐ Throttles	1,800 RPM (press F2 and F3 as necessary)
☐ Oil Pressure	MONITOR
☐ Fuel Pressure	MONITOR
☐ Oil Temperature	MONITOR

DESCENT

☐ Altimeter	SET
☐ Petrol Valves	VERIFY ON
☐ Throttles	REDUCE (press F2 as necessary)
☐ Airspeed	60-70 MPH

APPROACH

☐ Airspeed	60-65 MPH

LANDING

☐ Airspeed	60 MPH
☐ Throttles	IDLE (just before touchdown) (press F2 as necessary)

ENGINE SHUT-DOWN

☐ Throttles	IDLE (F2 as necessary)
☐ Petrol Valves	OFF
☐ Lights	OFF
☐ Magneto Switches	OFF (press M+Minus key until all Off)
☐ Master Switch	OFF

1903 Wright Flyer

STARTING

Press Ctrl+E to initiate engine autostart sequence.

TAKEOFF

☐ Throttle	FULL (press F3 as necessary)

APPENDIX C
Keyboard Reference Chart

Make sure your keyboard's Number Lock is toggled OFF before using the Number Pad commands. To add or customize keyboard commands and joystick buttons, select the* Options *menu, then click the* Controls *section, and finally click on the* Assignments *section.

Simulator Commands

PAUSE	P
Full Screen Mode	Alt+Enter
Display Menus	
(in Full Screen Mode)	Alt
Kneeboard Display/Hide	F10
Sound On/Off	Q
Reset Current Flight	Ctrl+; (Semicolon)
Save Flight	; (Semicolon)
Exit Flight Simulator	Ctrl+C
Exit Flight Simulator Immediately	Ctrl+Break
ATC Window Display/Hide	` (Accent)
Joystick On/Off	Ctrl+K
Cycle Coordinates/Frame Rate	Shift+Z
Select Item 1	1
Select Item 2	2
Select Item 3	3
Select Item 4	4
Select Time Compression	R
Increase Selection	= (Equal Sign)
Increase Selection Slightly	Shift+= (Equal Sign)
Decrease Selection Slightly	Shift+- (Minus Sign)
Decrease Selection	- (Minus Sign)

CONTROL SURFACE COMMANDS	
Bank Left (Ailerons)	Num Pad 4
Bank Right (Ailerons)	Num Pad 6
Aileron Trim Left	Ctrl+Num Pad 4
Aileron Trim Right	Ctrl+Num Pad 6
Yaw Left (Rudder)	Num Pad 0
Yaw Right (Rudder)	Num Pad Enter
Rudder Trim Left	Ctrl+Num Pad 0
Rudder Trim Right	Ctrl+Num Pad Enter
Center Ailerons and Rudder	Num Pad 5
Pitch Down (Elevator)	Num Pad 8
Pitch Up (Elevator)	Num Pad 2
Elevator Trim Down	Num Pad 7
Elevator Trim Up	Num Pad 1
Retract Flaps (Fully)	F5
Retract Flaps (In Increments)	F6
Extend Flaps (In Increments)	F7
Extend Flaps (Fully)	F8
Extend/Retract Spoilers/Airbrakes	/ (Fwd Slash)
Arm Autospoilers	Shift+/ (Fwd Slash)
Water Rudder Up/Down	Shift+W

ENGINE COMMANDS	
On multiengine aircraft, engine commands affect all engines unless you first select an engine by pressing E plus the engine number (1 through 4). To revert back to controlling all engines, press E plus *all* the engine numbers in quick succession (E+1+2, and so on).	
Engine Autostart	Ctrl+E
Cut Throttle	F1
Reverse Thrust (Turboprops/Jets)	F2 (Hold Down)
Decrease Throttle	F2 or Num Pad 3
Increase Throttle	F3 or Num Pad 9
Full Throttle	F4
Reheat/Afterburner On/Off	Shift+F4
Set Prop RPM to Low	Ctrl+F1
Decrease Prop RPM	Ctrl+F2
Increase Prop RPM	Ctrl+F3
Set Prop RPM to High	Ctrl+F4
Set Mixture to Idle Cutoff	Ctrl+Shift+F1
Lean Mixture	Ctrl+Shift +F2
Enrich Mixture	Ctrl+Shift+F3
Set Mixture to Rich	Ctrl+Shift+F4
Carb Heat/Engine Anti-ice On/Off	H
Select Engine	E
Select Magneto	M
Select Jet Starter	J
Increase Selection	= (Equal Sign)
Increase Selection Slightly	Shift+= (Equal Sign)
Decrease Selection Slightly	Shift+- (Minus Sign)
Decrease Selection	- (Minus Sign)

GENERAL AIRCRAFT COMMANDS	
Parking Brake Set/Release	Ctrl+. (Period)
Pushback Start/Stop	Shift+P (Then Press 1 or 2 to Turn Tail Right/Left)
Brakes Apply/Release	. (Period)
Apply Left Brakes	F11
Apply Right Brakes	F12
Landing Gear Up/Down	G
Manually Pump Landing Gear Down (If System Fails)	Ctrl+G (Move Gear Handle to On Position, Then Press Command As Necessary)
Smoke System On/Off	I
Open Cowl Flaps (In Increments)	Ctrl+Shift+V
Close Cowl Flaps (In Increments)	Ctrl+Shift+C
Select Exit Open/Close)	Shift+E (Then Press 1-4 to

Light Commands

All Lights On/Off	L
Strobe Lights On/Off	O
Panel Lights On/Off	Shift+L
Landing Lights On/Off	Ctrl+L
Landing Light Tilt Down	Ctrl+Shift+Num Pad 2
Landing Light Tilt Left	Ctrl+Shift+Num Pad 4
Landing Light Tilt Right	Ctrl+Shift+Num Pad 6
Landing Light Tilt Up	Ctrl+Shift+Num Pad 8
Center Landing Light	Ctrl+Shift+Num Pad 5

Radio Commands

ATC Window Display/Hide	` (Accent)
VOR 1 Indent On/Off	Ctrl+1
VOR 2 Indent On/Off	Ctrl+2
DME 1 Indent On/Off	Ctrl+3
DME 2 Indent On/Off	Ctrl+4
ADF Indent On/Off	Ctrl+5
Switch to Standby Frequency on Selected Radio	X
Select COM Radio	C
Select NAV Radio	N
Select OBS Indicator	V
Select ADF	A
Select DME	F
Select Transponder	T
Increase Selection	= (Equal Sign)
Increase Selection Slightly	Shift+= (Equal Sign)
Decrease Selection Slightly	Shift+- (Minus Sign)
Decrease Selection	- (Minus Sign)

Autopilot Commands

Autopilot Master Switch On/Off	Z
Flight Director On/Off	Ctrl+F
Autopilot Wing Leveler On/Off	Ctrl+V
Yaw Damper On/Off	Ctrl+D
Autopilot Altitude Hold On/Off	Ctrl+ Z
Autopilot Select Altitude	Ctrl+Shift+Z
Autopilot Heading Hold On/Off	Ctrl+H
Select Heading Bug	Ctrl+Shift+H
Airspeed Hold On/Off	Ctrl+R
Autopilot Select Airspeed	Ctrl+Shift+R
Mach Hold On/Off	Ctrl+M
Arm Autothrottle	Shift+R
Engage Autothrottle Takeoff/Go-Around (TOGA) Mode	Ctrl+Shift+G
Autopilot Nav 1 Hold On/Off	Ctrl+N
Autopilot Approach Mode On/Off	Ctrl+A
Autopilot Back Course Mode On/Off	Ctrl+B
Autopilot Localizer Hold On/Off	Ctrl+O
Autopilot Attitude Hold On/Off	Ctrl+T
Increase Selection	= (Equal Sign)
Increase Selection Slightly	Shift+= (Equal Sign)
Decrease Selection Slightly	Shift+- (Minus Sign)
Decrease Selection	- (Minus Sign)

Instrument Commands

Reset Heading Indicator	D
Reset Altimeter	B
Pitot Heat On/Off	Shift+H
Select EGT Reference Pointer	U
Increase Selection	= (Equal Sign)
Increase Selection Slightly	Shift+= (Equal Sign)
Decrease Selection Slightly	Shift+- (Minus Sign)
Decrease Selection	- (Minus Sign)

View Commands

Panel On/Off	W
Snap to Panel View	Shift+Num Pad 0
Cycle Views (Cockpit, Virtual Cockpit, Tower, Spot)	S
Cycle Views Backward	Shift+S
Display/Hide Add. Panel Windows (Radios, Engine Controls, GPS, Etc.)	Shift+1–9
Aircraft Labels Display/Hide	Ctrl+Shift+L
Create New View Window	[(Left Bracket)
Create New Top-Down View Window	Shift+] (Right Bracket)
Close View Window	] (Right Bracket)
Bring Window To Front	' (Apostrophe)
Zoom In	= (Equal Sign)
Zoom Out	- (Hyphen)
Set Zoom to 1X	Backspace
Instrument Panels On/Off	Shift+[(Left Bracket)
Switch To Top-Down View	Ctrl+S
Switch To Next View	Ctrl+Tab
Switch To Previous View	Ctrl+Shift+Tab
Select View Direction	Num Pad / (Fwd Slash)
Look Ahead	Shift+Num Pad 8
Look Ahead/Right	Shift+Num Pad 9
Look Right	Shift+Num Pad 6
Look Back/Right	Shift+Num Pad 3
Look Back	Shift+Num Pad 2
Look Back/Left	Shift+Num Pad 1
Look Left	Shift+Num Pad 4
Look Ahead/Left	Shift+Num Pad 7
Look Up	Ctrl+Num Pad 5

Look Ahead/Up	Ctrl+Num Pad 8
Look Ahead/Right/Up	Ctrl+Num Pad 9
Look Back/Right/Up	Ctrl+Num Pad 3
Look Back/Up	Ctrl+Num Pad 2
Look Back/Left/Up	Ctrl+ Num Pad 1
Look Ahead/Left/Up	Ctrl+Num Pad 7
Look Down	Shift+Num Pad 5
Move Eyepoint Back	Ctrl+Enter
Move Eyepoint Down	Shift+Backspace
Move Eyepoint Fwd	Ctrl+ Backspace
Move Eyepoint Left	Ctrl+Shift+ Backspace
Move Eyepoint Right	Ctrl+Shift+Enter
Move Eyepoint Up	Shift+Enter
Reset Eyepoint	Spacebar
Pan View Reset	Shift+Num Pad Del
Chase View On/Off	Ctrl+Q
Cycle Chase View Backward	Ctrl+Shift+W
Cycle Chase View Fwd	Ctrl+W

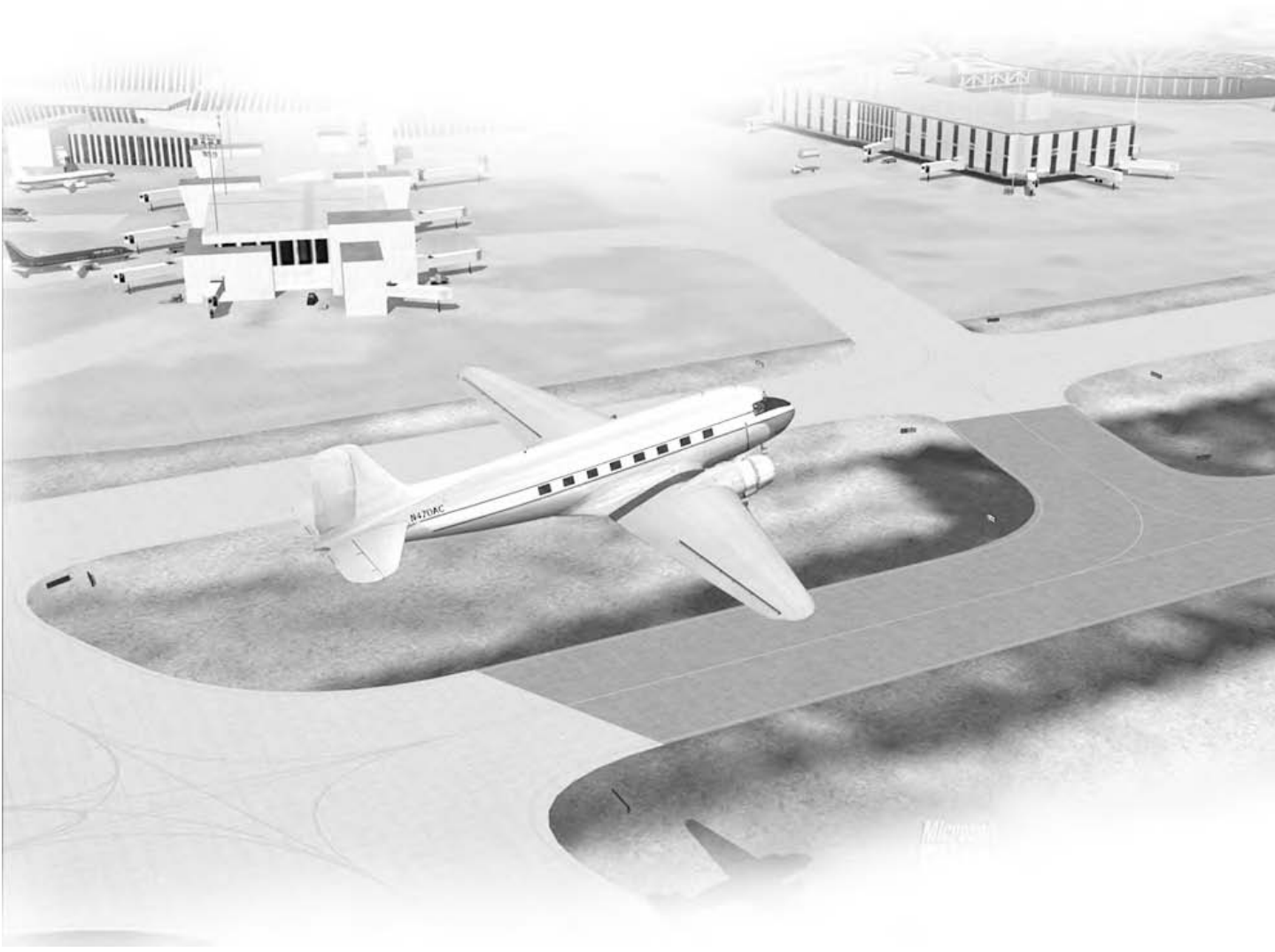
Slew Commands

Slewing allows you to rapidly reposition your aircraft without flying in real time. Use these commands to slew.

Slew Mode On/Off	Y
Set Heading North/ Attitude Straight-and-Level	Spacebar
Freeze All Movement	Num Pad 5
Move Forward	Num Pad 8
Move Backward	Num Pad 2
Move Left	Num Pad 4
Move Right	Num Pad 6
Move Up Slowly	Q or F3
Move Up Quickly	F4
Move Down Slowly	A
Move Down Quickly	F1
Freeze Vertical Movement	F2
Rotate Left	Num Pad 1
Rotate Right	Num Pad 3
Move Nose Up	9
Move Nose Up Quickly	F5
Move Nose Down	F7 or 0
Move Nose Down Quickly	F8
Freeze Pitch	F6
Bank Left	Num Pad 7
Bank Right	Num Pad 9
Move Eyepoint Up	Shift+Enter
Move Eyepoint Down	Shift+Backspace
Move Eyepoint Left	Ctrl+Shift+ Backspace
Move Eyepoint Right	Ctrl+Shift+Enter
Move Eyepoint Fwd	Ctrl+ Backspace
Move Eyepoint Back	Ctrl+Enter

Multiplayer Commands

Track Mode On/Off	Ctrl+Shift+D
Cycle Through Other Players	Ctrl+Shift+T
Follow Other Player	Ctrl+Shift+F
Switch To Observer Mode	Ctrl+Shift+O
Chat Window Display/Hide	Ctrl+Shift+] (R Bracket)
Switch Focus to Chat Window	Enter



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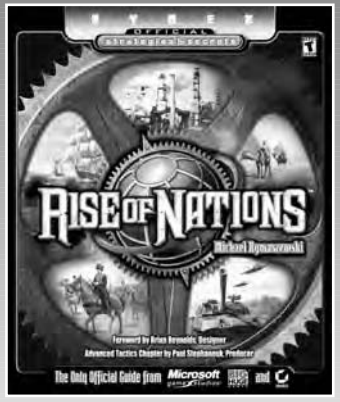

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